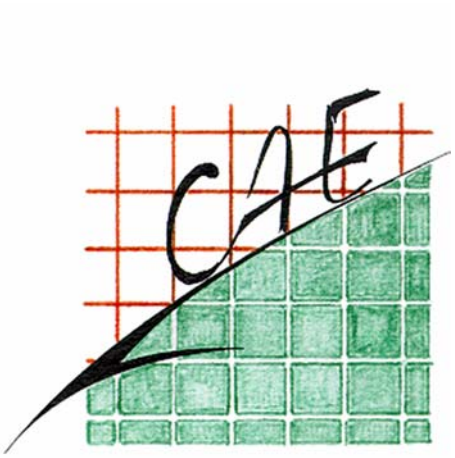

CENTRE AGRO-ENTREPRISE

Mali Sustainable Economic Growth

FEASIBILITY STUDY : A CATTLE AND POULTRY FEED FACTORY

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Executive Summary

Lack of a commercial industrial base for the production of animal feed in Mali is the main obstacle to rapid growth for this sector; it represents, however, a considerable opportunity for investment. The present feasibility study was commissioned to assess the prevailing business conditions in Mali's semi-intensive, commercial livestock sub-sector, with a view to analyzing the potential profitability of an industrial-scale factory for the production of high quality animal feeds.

Presently, the development of commercial, semi-intensive production enterprises, and the consequent capacity of this sub-sector to efficiently respond to rising consumer demand is severely constrained by the lack of a regular, year-round supply of high quality commercial animal feeds. The factory proposed in this study would in large measure overcome this key constraint and have an impact on the development of all commodity production systems in this sub-sector.

A multidisciplinary team undertook the study. A conservative evaluation of the existing and potential future market for finished livestock products was used as the basis for an evaluation of effective demand for animal feeds. This approach also enabled a characterization of the demand for finished livestock products and, as a consequence, for the range of rations that could be produced by an animal feed mill.

With regards to potential market share of effective demand by type of production system, poultry production, and specifically layer operations, was clearly the most accessible market opportunity for industrial feed in the immediate future. In this case, demand was estimated on the basis of an existing population of 450,000 birds (urban commercial units). This sector contains a significant core of professionals who are aware of the importance of using high quality rations and sound business principles in the operation of their production enterprises. The profitability of this commodity sector is highly dependent on the technical expertise of the producer. If the technical expertise is good, the profitability is excellent. Market analysis for this commodity sector showed a projected annual growth rate in the order of 4-5%. The current demand for poultry feed for egg production is estimated at 16,000 tons per year whereas the market for broiler feed remains very marginal.

The commercial livestock fattening market is fairly small in Mali. The current population is estimated at 33,000 head of cattle and 117,000 sheep. Profitability is good, and controlling feed costs is the key to maximizing profits. It seems likely that this market will grow steadily by around 1% per year over the next ten years. The demand for cattle feed in this sector is presently estimated at 15,000 tons per year.

The excellent profitability of dairy production, the very open market and the significant technical progress made in recent years make the dairy sector a promising market for the commercial animal feeds. Future growth is estimated at 2% per year because extension and adoption of improved production techniques, such as artificial insemination, is and will continue to be rather slow. The annual demand for dairy feed has been globally estimated at 45,000 tons, including maintenance rations.

Overall, the study identified an effective demand (commercial, urban production enterprises) for cattle and poultry feed in the order of 71,000 tons per year with an annual growth rate of 2-3%.

The study demonstrated that there is sufficient availability in Mali of major feed ingredients containing vegetable proteins, such as cereal grains, oilseed cake and industrial by-products of cotton and coarse grain processing, to support the operation of an industrial-scale feed mill. However, ingredients containing animal protein, such as blood and meat meal, and a substitute for fishmeal, will have to be imported, as will the mineral and vitamin supplements required in the formulation of balanced rations.

The technical needs of the production line for the feed mill proposed in this study were analyzed relative to finished feed output required to satisfy the demand of domestic markets. Consequently, the study has proposed a range of ten products, each intended for a very specific type of production. Given current conditions in Mali, feed mill design and operations have been proposed to promote development of its client base, minimize input (raw material) costs, consolidate its system of management, and facilitate and ensure its technical functioning in terms of construction, equipment and key technical assistance needs.

The overall initial investment has been estimated at: tangible assets - 2,619,948,000 FCFA: intangible assets, 45,000,000 FCFA; operating capital requirement (WCR), 715,600,000 FCFA. It is important to note that the high level of WCR results from the need to stock significant quantities maize and that quantities will double over the course of the first four years.

Subsequent to discussions between team-members and professionals from the banking sector, the study has proposed funding of 3,500,000,000 FCFA, which would allow a small margin for contingencies and a positive initial cash balance. Two-thirds of this amount would be guaranteed by a 2.3 billion FCFA medium-term loan spread over 7 years, at an annual rate of 12%, with a two year grace period. It is proposed that this loan become available when construction of the unit starts, that is, 9 months before production is due to start. This loan will generate interest charges of 216 million FCFA over its lifetime.

The analysis of the profitability of the factory took account of a hypothetical deregulation of the cotton oilseed cake market. Two scenarios were examined: production costs based on the official price, and those based on a deregulated price aligned with the factory sale price of an industrial animal-feed plant in the Ivory Coast.

In the scenario of a deregulated cotton oilseed cake market, the internal rate of return of the feed mill is 13.2% and the real net present value is 729M FCFA over 10 years. This estimation is based on *very cautious estimates* of domestic demand, the positive impact of the high quality feeds on animal productivity, the cost of inputs and the proposed sale prices of finished feeds.

This estimate of profitability relies on a 20% rise in estimated real costs of complete feed above the price currently paid for incomplete feed produced by HUICOMA. It

should also be noted that if the cotton oilseed cake market were to be deregulated, HUICOMA would be forced to raise its sale prices to compensate for the increased price of this input, and this would reduce the price differential between the two feeds.

If the cotton market were not deregulated, the IRR would increase to 15.9% and the NPV would attain 1390M FCFA.

This study did not evaluate the potential of the sub-regional animal feed market. However, the sale prices proposed in the study, with the addition of transport costs, remain lower than many standard prices for similar products in several important markets in the sub-region. This suggests the likelihood of competitive market position regarding distribution in the sub-region.

I. Introduction

The creation of a true commercial animal-feed production industry in Mali represents a significant investment opportunity. The present feasibility study was commissioned in order to analyse the current technical, economic and financial conditions of the modern livestock sector in Mali, with the object of determining the profitability of a commercial factory producing high quality balanced cattle feed.

Overall, the livestock farming sector in Mali contributes some 12-15% of Gross Domestic Product (GDP). In FCFA, the total added value of the sector has grown slightly since 1994. The percentage of Malian exports accounted for by livestock farming is slightly higher than the percentage of GDP it accounts for. The two main categories are animals on the hoof (20%) and leather and skins (1-2%). In the period 1993-94, under the impact of devaluation and simplified export procedures, recorded exports grew fourfold. In 1997, the value of livestock farming products exported was estimated at around 30.7 billion FCFA.

The three most important branches in the sector are, in the first place, cattle, small ruminants, and milk. These together account for 88% of livestock farming production. The remaining 12% is distributed among three other branches: poultry, egg-production, and leather and skins. In 1997, Malian livestock population was estimated at more than 6,000,000 cattle and 14,000,000 sheep and goats; the potential for red meat was estimated at 148,000 tonnes.[1] For several years, livestock farming development policy has placed particular emphasis on the intensification of production, and consequently, on the development of integrated production systems, notably agro-pastoral systems. This policy has favoured the emergence of intensive production systems which are increasingly oriented toward livestock fattening and the production of quality animals.

The poultry branch is also growing rapidly thanks to the development of semi-commercial units. These units have a population estimated at 450,000, with an annual growth rate of 15-25%. These commercial ventures are focused more on egg than meat production.

The development of modern production units, and consequently the capacity of the sector to respond to increasing demand, is limited by the lack of regular (year-round) supplies of quality balanced animal feed. The factory proposed in this study would answer this key need for all branches in the sector.

The study was entrusted to an multidisciplinary international team. The team leader was a French financial specialist with considerable experience in setting up industrial factories. He was supported by three other members: an American specialist in industrial production of animal feed and two Malians, one specialising in agricultural economics and the other in animal production and nutrition. The study took place over a period of eight (8) weeks and began with a briefing meeting with a Pilot Committee composed of a small group of economic operators/producers from various regions of Mali. This Committee provided the team's technical advice and support during the elaboration of the study.

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[1] OFFICE MALIEN DU BETAIL DE LA VIANDE (MALIAN CATTLE AND MEAT OFFICE, OMBEVI), 1998.

The strategy adopted by the team for the execution of the commission was to concentrate on an analytic (and classic) evaluation of i. the existing market and ii. the potential for the finished livestock-farming products, as the basis for an evaluation of the effective demand for commercial animal feed. This approach to the branch allowed the characterisation not only of the range of products that could be manufactured in the factory but of the demand for finished products. To this end, the study took the form of meetings and discussions with producers, economic operators, and private and state support structures in the zones considered most important to the proposed animal-feed factory (Bamako, Koulikoro, Ségou and Sikasso).

II. Characteristics of Demand for Poultry Feed and Cattle Feed

This chapter offers an in-depth analysis of the effective demand for commercial feed. The analysis was conducted on the basis of branches. The basic hypothesis was as follows: the effective demand for complete feed will to a large extent be determined by the real profitability of production units. Obviously, this profitability is closely linked to demand for finished products such as meat, milk, eggs, etc.

Therefore the real and potential demand for commercial feed has been calculated on the basis of a very classic analysis of the national market[2] for finished products of animal origin.

A target group was selected (the peri-urban producers who constitute the most dynamic of the markets and are considered the most reliable group of clients for any proposed enterprise) as the framework of the analysis. The characteristics of effective demand, present and future, for commercial feed were established for each branch of the sector on the basis of three essential factors: market potential, the profitability of the activity and the existence of support funding.

A. Poultry.

1. Introduction

The poultry branch is based on a traditional system of production. At least 90% of the poultry population receives no composite feed. This lack of balanced food is reflected in the low real productivity (laying yield 60/80 eggs per annum, broilers attaining one kilogram after six months).

The overall poultry population is estimated at 22 million birds, but this estimation is ten years old and based on inadequate data. Despite low productivity, traditional poultry rearing provides an export flow of 8-10,000 chickens/week from the Sikasso region to the Ivory Coast.[3] It also supplied the majority of the 4.2 million chickens consumed annually at Bamako in 1996[4], and, lastly, provided the entirety of the very large numbers of guinea fowl consumed in Mali as a whole.

Modern poultry farming has been expanding since the beginning of the century in Mali, especially in the peri-urban zone of Bamako. Characteristics of the new system of production include an improved use of feed, and entrepreneurial procedures in terms of the calculation of the costs and cycles of production. This is the only segment of the branch for which more or less objective and serviceable data is available, but the data concerning population substantially underestimate the reality.

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2 THE OPPORTUNITIES AFFORDED BY THE REGIONAL MARKET WERE NOT TAKEN INTO ACCOUNT IN THE STUDY BUT ARE DEEMED VERY SUBSTANTIAL.

3 427,000 IN TOTAL FROM SIKASSO IN 1998 (DRAMR) AND 55,000 FROM SEGOU TO THE DIRECTION REGIONALE D'APPUI AU MONDE RURAL.

4 INFORMATION FROM THE PROJET DE DEVELOPPEMENT DE L'AGRICULTURE PERI-URBAINE (PDAP).

Precise evaluation of stock is difficult, since, as everyone agrees, the sector is a state of permanent flux; the market's reputation for profitability attracts new operators daily, and the majority of these go under almost immediately, after failing to master one or other aspect of the activity (sanitary control, breeding, marketing). One can only attempt an approximate evaluation drawing on a variety of sources.

2. Population

The sources used provide estimates rather than a precise census, and even this is possible for only three regions: Bamako (district), Ségou and Sikasso.

In the Bamako district, there was a population of around 100,000 `modern' layers and 15,000 broilers in 1996.[5] However, this population has rapidly increased since then, and in last April the Bamako market experienced a glut, which was much clearer-cut than the fluctuations usually experienced.

In the Sikasso region, the DRAMR specialist estimates the current population at 30,000 layers: 15,000 in the Sikasso circle, and 15,000 in the other circles (Bougouni, Koutiala and Kadiolo). These populations are, however, increasingly rapidly, and further such growth can be expected in the short term. Note that broilers appeared for the first time in 1998 in Sikasso and Bougouni, with the establishment of an gold-mining company (around 2,000 chickens produced).

In the Ségou region, according to the DRAMR, production in 1998 was 5300 broilers and 4.9 million eggs. Observed yield with LEGHORN chickens was around 200-250 eggs/year. This would correspond to an estimated 20,000 layers.

Finally, modern poultry farming exists, it is said, in embryonic state in the regions of Kayes (particularly at Kita) and Mopti, but no precise information was available.

An evaluation made in the context of the renewed activity of the SOTUBA poultry centre reported 258,000 chicks imported in 1995. Of these, 214,000 were layers. Eggs for hatching were not at that time imported.

If we allow an average 24% loss over the life cycle, that is, 16% loss by halfway through the production cycle, the average potential production for the following year, 1996, should have been around 180,000 birds (100,000 of these being destined for the Bamako market). In broiler production, the loss rate is around 20%, and potential average production would not exceed 35,000 (15,000 for Bamako).

As to import of one-day chicks and fertilised eggs, we have the data recorded by the control post of the Direction Régionale de la Réglementation et du Contrôle of the Ministère du Développement Rural (MDR) at Bamako's Sénou Airport. This data shows that one-day chick imports increased around 20% between 1995 and 1998 (21,000 to 31,000 chicks).

Until 1998, only MALI POUSSINS imported fertilised eggs; it imported 16,000 eggs in 1998. In 1999, however, a second operator appeared on the market, PHARMAVET

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5 ACCORDING TO THE PDAP.

KONE, which has already imported 42,000 fertilised eggs since the beginning of 1999; they are destined for the Sikasso region. Neither company is yet importing broiler chicks.

In addition to the one-day chicks imported via Sénou Airport, the Sikasso population, that is, 30,00 layers, must be estimated with regard for the fact that many chicks are, apparently, imported overland from the Ivory Coast. We have therefore added a further 5% to the Sénou Airport imports in order to obtain a fairly exact figure. The total imports of chicks (females only) would therefore be as follows:[6]

- 1995: 230,000
- 1996: 141,000
- 1997: 221,000
- 1998: 363,000

The second phase of analysis consists in an evaluation of the population of layers. This must take account at any given moment of:

- the length of the production cycle, around 19 months
- the distribution of imports over the course of the year, which we have taken as uniform. The imports of a given year thus affect the population for some thirty months;
- the mortality rate, which was estimated at 2% per month over the cycle as a whole, or a cumulative loss exceeding 25% of the initial stock at the point when the flock is culled.

The exact tendency constituted on the basis of this analysis of the changing population of layers (including chicks and pullets) since 1995 gives a **population of 450,000 birds at 1 January 2000, which we shall retain as our initial market hypothesis (see Annex II).**

The evaluation of production of broilers is much easier, since the production cycle is limited to some 50 days. Production is therefore reducible to imports minus mortality (20%). This suggests production of around 45,000 chickens for 1998, which remains very low.

Note however that `to be added to this are the young cockerels born of imported fertilised eggs, which are raised almost like broilers, even though their growth is slower (3-5 months)'. Thus Mali Poussins sold 67,000 young cockerels in 1998.

3. Current Practices

There is at present no systematic census of producers. In 1996, the Bamako district registered 108-120 `modern' producers.[7] Some thirty major poultry farmers are in production in the Sikasso region. We do not have any precise data for Ségou, but the figure must be similar there. It seems reasonable to estimate the number of `modern' poultry farmers in the country at about 200; this is the estimated number of clients of Mali Poussins, though many of these are amateurs only.

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6 ACCORDING TO THE DIRECTION REGIONALE DU DISTRICT DE BAMAKO.

7 SEE ANNEX - BIBLIOGRAPHY - PDAM NO. 13.

The PDAP attempted a typology of the poultry farmers of Bamako. Three types were found:

- **Type 1:** often beginners, with a maximum of 500 birds. Production of 5-10 egg-trays/day. Buy chicks through intermediaries (around F800). Approximate veterinary monitoring. Equipment and buildings frequently inadequate. Feed supplies from local mills, often on credit during start-up. No distinctive pullet formula. No CMV. Frequent stockout problems.

- **Type 2:** 500-2000 birds. Production up to 30 eggtrays/day. Buy chicks directly or in association with one another (around F700). Relatively rigorous veterinary monitoring. Supplied by district markets. Stocks sometimes low. Feed manufactured daily. One or two salaried staff.

- **Type 3:** 2,000-10,000 head. Production up to 130 eggtrays/day. Sometimes also produce broilers. Direct supply of chicks (around F650). Employ vets to monitor the procedure. Well-designed buildings, self-contained equipment for feeding (grinder, scales). Large ingredient stocks but constantly facing feed quality problems.

We may therefore take the figure of 1000 layers as offering a sort of threshold of professionalization at which the activity of the egg-producer begins to stabilise. The production of broilers involves higher technical and risk levels (mortality, low demand) and would seem to be confined to experienced poultry breeders. They are currently rather few.

We have worked out a generic trading account for establishments of Type 2 (1000 layers) and Type 3 (4000 layers). The results (see Annex 1 for the calculations) suggest that Type 2 produces profits of 2.5 million FCFA while Type 3 produces more than 3 million FCFA or a net income per layer of the order of 2500-3000 FCFA and a net margin of 28-30%.

4. Evaluation of Current Demand for Poultry Feed

The vast majority of poultry farmers make their own food to their own formula. All use at least 18-20% fishmeal for chicks (sometimes as much as 24%!), and at least 15% fishmeal for layers, despite their complaints about price and quality. Oilcake accounts for 4-10% maximum. It is considered a supplement to fishmeal.

Maize accounts for 50-60% with the layers and 60-70% for the chicks. Among producers, no one uses sorghum and no one modifies rations according to least cost. All use oyster shell as source of Ca (not tri-phosphate, no bonemeal). Almost all use 0.5% salt and 0.2% CMV.

The manufacturing cost of rations made on the farm varies between F125-150 according to a PDADP survey. During our interviews, one of the best organised producers specified the price of F120. As to complete feed made from pre-established formulae, these have been manufactured and sold only in marginal quantities up to

now. The most active enterprise in this field to this date would seem to be COPRAAV at Ségou, which is of artisanal scale but well managed. Its feed is sold in the form of meal not granules. Their basic price is F165/kg, but bulk discounts can reach F30. Prices for pullet and chick feed are identical.[8]

The individual needs of a layer over its lifetime can be evaluated at 56.5 kg/head/cycle.[9] This comprises:

- Chick feed (till 8 weeks): 1,820 kg
- Pullet feed (till 20 weeks): 6,930 kg
- Layer feed: 47,740 kg

On the basis of a population of around 450,000 birds, and a total cycle of 19 months, average annual consumption can be evaluated as in Table 1. (The market evaluation has been rounded off in view of the lack of precision concerning the exact population figure.)

Table 1: Evaluation of Quantitative Needs (January 2000)

Population=450,000	**Chicks**	**Pullets**	**Layers**	**Total**
Consumpt./bird /cycle (kg	1.82	6.93	47.74	56.5
Total consumpt./ cycle (t)	819	3118	21483	25420
Total Consumpt./ Year (t)	517	1969	13568	16054
Market Evaluation (t/year)	**500**	**2000**	**13500**	**16000**

5. Market Development Perspectives

We could attempt to use our own model on the recent evolution of the layer population to establish the trend for the next few years, on the hypothesis of the livestock population increasing parallel with consumption. Linear progression gives us a population of 450,000 birds early in the year 2000. Continuation of this trend would triple the population by 2010, which seems extremely unlikely, even in the most optimistic scenario.

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8 For the sake of precision, we should also note ALBELO: F160 (palletised but major manufacturing and management problems) and KONE F275 (too expensive, since it includes fish, which should anyway be avoided).

9 Laying begins in the 20TH week; cull after 62 weeks of laying; 15 g/day the first week; increase of 5 g/day each week until the 20TH week, thus 110g.

The income-elasticity of eggs (like that of milk) in the urban milieu has been estimated at 0.8-1.2,[10] which suggests that 1 should be used as reference value. The other market development parameters are:

- The growth of the urban population over the next 10 years, estimated at 4.6%
- Increase of average income: probable value 1%.

These values suggest a market increase of around 50% during the next ten years, which seems a plausible hypothesis. **We therefore retain the index 150**.

As we have seen, demand relates above all to peasant production, industrial production being at best emergent (45,000 `modern' pullets in 1998). But recent prospective studies on the livestock sector in Mali (Metzel *et al.*, 1997, and KIT, 1998, now being finalised) indicate that Mali is in danger of losing its exportable surplus of red meat if the Malian consumer is not offered white meat to replace it, in particular poultry, since pork is of course marginal.

There is therefore good reason to favour accelerated development of broiler producers, and to increase their productivity in order to lower the price of white relative to red meat. This is an indispensable condition for white becoming a substitute for red meat, irrespective of hypothetical rises in income. Demand for white meat was estimated by KIT in 1998 at 2,200 t, or 2,06 kg/ inhabitant, that is, less than half the official OMBEVI estimates.

The KIT hypothesis is based on a reduction in the price of poultry meat from 1429 to 1200 FCFA/kg by 2010. Under these conditions, and according to the hypothesis considered most likely for income rises, that is, 1%/year, the demand for white meat would rise from 22,000t in 1990 to 50,000 t (3.9 kg/ inhabitant). This constitutes 127% growth relative to 1998. **On the basis of 100 in the year 2000, production would therefore attain the index 189 in 2010, which we take as our reference value.** This index of overall sectorial growth represents a minimum value for the modern sector, which is obviously expected to grow much more quickly than the rest.

In all the scenarios studied, the country will therefore experience a meat deficit and will have to import significant quantities. The development perspectives for this sector are therefore highly significant, despite its current marginal status. However, the Malian consumer is used to traditional farmyard chicken, and it remains to be seen whether consumer taste will adapt to the greater tenderness of industrial chicken. Moreover, low-price imports will no doubt constitute a serious threat for local production. Evaluation of potential exports to neighbouring countries, in particular the Ivory Coast, are outside the remit of this study. But they are certainly not negligible, given that Mali already exports large quantities of traditional chicken.

Competition from feed manufacturers already exists, notably in Ivory Coast and Senegal. In the Ivory Coast, the main manufacturer is IVOGRAINS at Abidjan, which

10 VARIOUS STUDIES CITED BY THE KIT/IER TEAM IN THE STRATEGIC ORIENTATION STUDY OF LATE 1998.

produces a wide range of palettised feeds, above all for poultry, but also for pigs and fish. The ex works price list is as below:

Table 2: Ex Works Prices for Certain IVOGRAIN Products

Product	**In FCFA/kg**
Pullet starter	188
Pullet growth	165
Layer	168
Broiler starter	188
Broiler growth	186

(source: manufacturer)

Given the cost of granulation, these prices are comparable to those of COPRAAV. However, the manufacturer is the first to note that the very high harbour dues on the Malian market (at least 60%) make it prohibitively expensive. Even were there a reduction (or even abolition) of these dues under UEMOA regulations, the cost of transport from Abidjan would remain high (around F30/kg), adding considerably to the Bamako price of the product. It therefore seems likely that competition, and therefore the threat posed by other manufacturers in the sub-region, would be limited.

6. External Financial Support for the Sub-Sector

The principal financial support for the sub-sector is constituted by the Banque Arabe pour le Développement Économique de l'Afrique, which financed the Projet de Développment de l'Aviculture du Mali (PDAM - Malian Poultry Development Project) to the tune of 3.2 billion FCFA. This project includes a `credit' component, which will, in theory, be in a position to finance not only the producers themselves (in particular as regards equipment), but the up- and downstream operators in the branch: chick and feed producers, traders and slaughterers (abattoirs). This funding is supposed to be distributed through the conduit of village associations and professional organisations.

These intermediary structures have not yet been fixed and the project is still subject to numerous uncertainties; it has been very slow to start.

7. Conclusions

The market niche for egg-producers, with a volume of around 16,000t, is clearly the most accessible in the immediate future for industrial feed. The sector presents a significant core of professionals of a good standard, who are conscious of the importance of balanced food and aspire to rational management of their farms. The profitability of the branch is in direct proportion to the technical level of the producer; where the technical level is high, so is the profitability.

Despite a cyclic development characterised by periodic crises, the market will no doubt maintain its expansionary tendencies, thanks to the growth of the urban population and the slow but steady improvement in living standards.

The broiler market remains very marginal for the moment, but should undergo very rapid development in the years to come, thanks to the predicted substitution of red by white meat; white-meat production costs can be significantly lowered. However, a number of uncertainties hang over this niche, and it can represent only a marginal consideration in the project development plan.

Competition from sub-regional manufacturers does not, for the time being, present a significant threat.

B. Livestock Fattening: Cattle

1. Introduction

It has traditionally been possible to divide the bovine population of Mali into six main production systems: three `pastoral' systems and three "agropastoral" systems.

The characteristic of the pastoral systems is owners who accord priority to the number and survival of the cattle; that of the agropastoral systems is the producers, who supply feed to supplement the common pasture or crop residues, with the intention of fattening the animals before slaughter. The pastoral systems are an essential element of the cattle/meat branch, as it is the source that supplies almost all the animals fattened by the producers. Moreover, the agro-pastoral systems and the fattening units offer a real opportunity to obtain added value.

Nevertheless, a seventh system, known as `semi-intensive' has grown up rapidly over the last few years around the urban centres, above all Bamako, and through associations or co-operatives of cattle farmers. This system comprises seasonal fattening activities, but above all dairy production. **It is the only system for which one can attempt to evaluate objectively a demand in concentrate feed supplements.**

It is generally admitted that the lack of year-round adequate nutritional sources for animal feed and forage is one of the main technical constraints limiting animal productivity. This make the development of commercial enterprises for the production of animal feed a key and strategic factor for the development of the sector and the growth of value added.

2. Population

We base our estimates on the data supplied by the DRAMRs on the number of fattening cattle per region during the 1998-99 season.[11] This data appears in Table 3.

11 NO FIGURE IS GIVEN FOR THE REGIONS OF GAO AND KIDAL, WHERE THIS ACTIVITY IS EFFECTIVELY NON-EXISTENT.

Although the figures must be treated with caution, the data is consistent with evaluations carried out during the recent past[12] and with our own isolated observations in the field.

Table 3: Population of Fattening Cattle in 1998 according to the DRAMRs

Region	Population	Average length (days)
Kayes	1195	60
Koulikoro	6961	80
Sikasso	1740	60
Ségou	19296	80
Mopti	1482	60
Timbuctu	170	60
Bamako District	2000	80
National Total	**32844**	

Thus, the major fattening zones are the peri-urban zone of Ségou, the Banamba and Fana localities in the Koulikoro region and the peri-urban zone of Bamako; a long way behind come Sikasso (including Koutiala), Mopti and Kayes.

Ségou is by some distance the main fattening area, in which a few dozen large operators account for the majority of the production. Each processes hundreds, and in some cases thousands of head of cattle every year in two or three rotations. The produce is principally for the market of Ségou (the town) but also for export to the Ivory Coast and for the Bamako market.

Banamba is known as an important traditional fattening zone, and there one finds some operators of excellent technical level, who send the majority of their products to the market at Kati, on the outskirts of Bamako. Fana is also known as a important centre, and has the benefit of the presence of the CMDT. Recently Kita (in the Kayes region) has established itself as a centre of similar kind.

As to the number of cattle currently fattened in the Bamako district, this was established on the basis of our own evaluations following discussions with the DNAMR, on the one hand, and the Abattoir Frigorifique de Bamako (ABF) on the other. According to the latter, fattened cattle are slaughtered exclusively in the hot season (around 100 days), and account for around half of all daily slaughters, that is, 150 head. To these must be added the other slaughters taking place at the other controlled slaughtering sites of the town, this amounts to around 25% more. This gives a figure of 9400 controlled slaughters of fattened cattle per year at Bamako; by our own estimates, only 2,000 of these are bred locally. The Bamako market probably amounts to around 10,000 head if the non-controlled slaughters are taken into account.

In total, and assuming that the DRAMR data is reliable, it seems that the market for fattening cattle in Mali today is divided up as follows:

12 SEE ANNEX: BIBLIOGRAPHY: DIAIKITE *ET AL,* 1994, NO.2.

Table 4: Estimate of the Fattening Cattle Market in Mali in 1999

Destination	Number of Heads of Cattle
Export	18,000
Bamako Market	10,000
Other Major Towns	5,000
TOTAL	**33,000**

3. Current Practices

In Mali, there are essentially two systems of fattening: peasant and intensive. Peasant fattening is practised in the profit-oriented agro-pastoral systems of the Office du Niger, Office Riz Ségou, CMDT and OHVN zones. It is characterised by small farms (1-5 head), peasant technical levels, which vary from one zone to the next, a low level of inputs, and modest productive investments, often confined to the purchase of a manger and the establishment of rudimentary pens. Its main purpose is the fattening of retired working oxen and thin animals from village herds.

Intensive fattening takes place in the peri-urban zones, essentially in the areas around the regional capitals; the radius of this area is about 25-100 km for the peri-Bamako area. To these areas should be added the zones of Banamba, Fana and Koutiala.

It uses a more substantial infrastructure: buildings, pens, wells, vehicles, cement mangers and hayracks in some cases. Its main purpose is the fattening of thin animals from the pure pastoral system of the north of the country, or the semi-fattened animals from peasant fattening. These fatteners are relatively professional and entrepreneurial.

In general, the feed is composed of coarse fodder brought in *ad libitum* or pastured (brush straw, cereal straw, or leguminous plant tops) or concentrate: ABH (Aliment Bétail Huicoma: Huicoma cattle feed), cotton oilcake, and wheat and millet bran, given in variable quantities according to the type of concentrate, the locality, the fattening system and the season.[13] The fatteners interviewed gave some general indication of the ration that they provide, and the approximate quantities of concentrate given daily per head, in addition to straw, which is often enriched with molasses. Thus:

- Banamba fattener: 5-7 kg of cotton oilcake
- Bamako fattener: 5-7 kg (ABH + Ashkar bran).
  7 kg for finishing animals

The animals are never weighed; the breeders do not see the point of this, as transactions are judged by eye. It is therefore all but impossible to obtain an idea of weight on entry, weight on exit and average daily gain (ADQ).

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13 DISCUSSIONS WITH THE FATTENERS GIVE ONLY AN APPROXIMATE NOTION OF CURRENT PRACTICES CONCERNING THE AMOUNTS OF FEED DISTRIBUTED PER ANIMAL PER DAY. STILL LESS DO THEY PERMIT ONE TO DETERMINE THE OPTIMUM TECHNIQUE FOR USING THE INGREDIENTS AVAILABLE ON THE MARKET.

The duration of the fattening process as current practised is very variable. In the CMDT zone, the fattening period lasts between 40 and 91 days. Our interviews suggest that the average is 67 days at the SUKALA workshop, 82 days at Banamba and 80 days in the peri-Bamako area. In general, the duration of intensive - that is more `professional' - fattening is longer than that of peasant fattening. But it never exceeds 90 days.

In the other regions, the fattening period is often much shorter. 50-day fattening periods are frequently recorded. A survey in the Bougouni area indicated an average of 60 days. This would seem to be the minimum period for professional fattening. We therefore chose it as the reference value for zones other than those already cited.

We chose 80 days as our reference value for regions where this type of fattening is dominant, i.e. Ségou, Koulikoro and Bamako district.

The DRAMR of Ségou indicated that for the most recent season, average profits were of the order of 50,000 FCFA/head in bovine fattening and 30-40,000 FCFA/head in ovine fattening.

Following a profitability study performed in 1998 for USAID,[14] the average margin in fattening, expressed in terms of net profit per animal-day or `fattening-unit' in 1997 would be 475 FCFA for cattle and 305 FCFA for sheep. This would give a net margin of the order of 27,500 F/head for sheep and between 28,500 and 42,750F/head for cattle for average (60 day) to long (90 day) fattening periods.

This figures are more or less consistent with the margins revealed by the some of the fatteners interviewed during the present study. Two large Ségou breeders for example gave their net margins per head (of cattle) as 30,000 FCFA, which is no doubt an underestimate.

An IER study[15] on the consequences of devaluation for the livestock sub-sector in 1997 gave a largely positive response for cattle fattening. The results, after devaluation, relative to a sample of farms in the Kayes, Sikasso, Ségou and Mopti regions and Bamako district, are summarised in the table below:

14 SEE ANNEX - BIBLIOGRAPHY: METZEL *ET AL.*, NO 12.

15 SEE ANNEX - BIBLIOGRAPHY: KONE AND SONOGO, NO 9.

Table 5: Production Costs for Bovine Fattening According to Koné and Sanogo

	Value/head	**%**
Feed	**19039**	**84**
Veterinary fees	1112	5
Labour force	856	4
Fixed costs/ Depreciation	1588	7
Total costs	**22595**	**100**
Net margin	**24958**	

This cost structure seems clearly more consistent with our interviews and nearer to the Malian average if peasant fattening is included. Regardless of system and duration of fattening, feed no doubt accounts for ¾ of production costs (purchase of thin animals excluded). The veterinary fees and workforce costs are relatively minimal.

However, in absolute values, the feed costs for intensive peri-urban fattening, the main target of the project, can be considerably higher than the values given above. Concordant estimates by breeders from Ségou and Bamako district indicate a total production cost of F4,0000/head for bovines, making F3,0000 in feed if we hold to the hypothesis of feed making ¾ of total cost. This level is easily attained if ABH or oilcake is bought from a retailer. Some sources report `overfeeding' corresponding to excessive ration costs (up to F37,000) in some Bamako district breeders. The following ration, nonetheless, practised by one of the major fatteners of the district, can, we feel, serve as our reference:

Table 6: Bovine Fattening Ration Commonly Practised In Bamako District

Ingredient	**Cost/kg**	**Kg/day**	Cost/60 days (short)	**Cost/80 days** (long)
Brush straw	10	6	**3600**	4800
ABC	50	5	15000	20000
Bran	35	1	2100	2800
Total cost			20700	27600
Supplement cost			**17100**	**22800**

This corresponds to 345F/day fattening expense, of which F285 is spent on the supplement, for an average ADG of 0.8kg, which we propose to take as our reference value.

4. Evaluation of Current Demand for Cattle Fattening Feed

It is certain that the feed demand relative to fattening animals represents only a very small fraction of the total feed needs of the country. Thus theoretical cattle feed demand for the Koulikoro, Ségou, Sikasso zones and the Bamako district was estimated at 447,424 tonnes in 1993.[16] In a previous study[17], national needs were estimated at 918,220 tonnes in 1992, while another study[18] estimated them at 864,287 tonnes in 1995. These figures are consistent regardless of the type of business concerned.

However, these estimates are based on populations and theoretical individual physiological needs; they give no indication of the solvent commercial demand. This is the more true, given that the real population figures of the herds are even today only approximately known, and that, in the traditional and extensive production systems, recourse to industrial feed is not at all systematic; in some cases, it is exceptional.

In the context of current fattening practices for ruminants in Mali, only a concentrated feed supplement can be considered for industrial manufacture. For, depending on season, the feed base is found either at pasture during wintering, or, after wintering, in the coarse fodder constituted by brush straw, crop residues, or, less frequently, by hay from cultivated fodder brought to the trough.[19]

It is therefore best to confine oneself to current practices, that is, to the supplementation of a rudimentary feed. Two types of concentrate are proposed: starter and finishing feed. The starter feed is distributed as a supplement to brush straw, but with the finishing feed, brush straw is not necessary thanks to a higher proportion of cotton seed.

Daily needs are evaluated in terms of the nutritive value of the concentrate envisaged and the performance expected. In the case of the starter feed proposed here, and during the envisaged duration of use, the ADG remains of the order of the that currently observed: O.82 kg/day. The need is for 4.1 kg supplement with 4.2 kg of brush straw.

In the case of the finishing feed, on the other hand, the expected average ADG is 2.3 kg/day for short fattening, 2.15 kg/day for long. The need is 9.2 kg/day of concentrate.

The data above nonetheless show that a successful short fattening (60 days) should produce an overall gain of 60 kg, corresponding to a ADG of 1 kg/day. It seems unlikely that the long fattening (80 days) currently produces overall gains of above 80 kg/animal. We shall therefore retain these standard values in terms of objectives for short and long fattenings respectively.

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16 See Annex - Bibliography: Diakite *et al.,* No 3.

17 See Annex - Bibliography: Diakite *et al*., No 2.

18 See Annex - Bibliography: Maiga, No 11.

19 According to the results of Doumbia (Metzel *et al*) brush straw accounts for 60% of bovine fattening food.

The objectives defined above can be attained by various combinations of starter and finishing feed. Here we have chosen a plausible combination, according to which the distinctive aspect of the long fattening is a longer finishing period. The duration of the starter phase has been fixed for all cases at 30 days. With the proposed feeds, the respective durations of the finishing phase thus become:

Table 7: Production Objectives of the Two Fattening Systems

Fatten-ing Type	**Target** (kg)	**Starter**	**Starter**	**Finish**	**Finish**
		Kg Gain	**No. Days**	**Kg gain**	**No. Days**
Short	60	25	30	35	15
Long	80	25	30	55	26

The gain in time relative to our reference durations thus becomes respectively 15 and 24 days. Thereafter, overall needs can be calculated on the basis of standard durations in short and long fattening, daily needs and population.

Table 8: Evaluation of Concentrate Needs for Bovine Fattening

	Population	**Standard Duration (days)**		**Daily Needs Kg/day**		**Finishing**	
		Starter	**Finishing**	**Starter**	**Finishing**	**Starter**	**Finishing**
Kayes	1195	30	15	4.1	9.2	147	165
Kouli-koro	6961	30	26	4.1	9.2	856	1665
Sik-asso	1740	30	15	4.1	9.2	214	240
Ségou	19296	30	26	4.1	9.2	2373	4616
Mopti	1482	30	15	4.1	1.2	182	204
Tim-buctu	170	30	15	4.1	9.2	21	23
Bamako Dist.	2000	30	26	4.1	9.2	246	478
TOTAL	**32844**					**4039**	**7391**

5. Market Development Perspectives for Cattle Fattening

The fattening animals constitute a small fraction of the total of cattle marketed in Mali; in some cases, they are presented on local, intermediary and/or terminal markets; in others, they are sent directly for export, where, again, they are presented on markets (such is notably the case with the Ivory Coast). In the view of the operators interviewed, the export market can be more remunerative, but it is also riskier.

The Ségou fatteners would seem to handle the export market fairly expertly. In other cases, in particular Sikasso, the producers prefer to confine themselves to the local

market, which pays sufficiently well. There is therefore competition between the local and export markets for cattle in general.

On the domestic market, the demand for fatstock meat is exclusively urban. Let us therefore suppose that the evolution of the fattening market will be proportional to that of the sum: domestic urban demand + exportable surplus of red meat in general.

Certain recent studies[20] have attempted to evaluate the development of the exportable surplus over the years to come as a function of the evolution of domestic demand. In the analysis of supply and demand of red meat in Mali (Doumbia and Metzel, 1997), several scenarios were presented, with a view to estimating the development of domestic supply and demand, and thus of the exportable surplus.

According to this study, the evolution of urban demand follows population on the one hand, and income on the other. Here we adopt the most likely of their scenarios. Thus:

- Urban population growth rate: 4.6%
- Income growth rate: 1%

The results are synthesised in the following table:

Table 9: Evolution of Bovine Meat Demand (in CT*) (Doumbia and Metzel):

	1995	**2000**	**2005**	**2010**
Urban demand	19,989	25,648	32,421	40,556
Exportable surplus	34,383	36,235	37,428	36,592
Total	54,372	61,883	69,849	77,148
Variation % (base 2000)	**88**	**100**	**113**	**127**

***CT- Carcass Tonnes**

Here we see that urban demand for bovine meat should increase by 60% between 2000 and 2010, while the exportable surplus should remain more or less at the same level.

In another study undertaken in late 1998 and currently being finalised, the team of experts from the KIT (Royal Tropical Institute) of Amsterdam and the IER adopted many of the hypotheses of Metzel *et al.* However, they also included in their projections of red-meat consumption i. their forecast of the evolution of white-meat consumption (essentially poultry), and the movement of their relative prices, and ii. a refined consumption model.

Using hypotheses similar to the above (income growth at 1% p.a.), which they took to be the most probable, the KIT study concluded for an overall domestic demand of the

20 SEE ANNEX - BIBLIOGRAPHY: METZEL *ET AL,* NO 12.

order of 125,000 t of red meat in 2010 (in carcass weight, excluding cameloids). By applying the following ratios:

- 1 urban for 2.3 rural in 1998, 1 urban for 1.66 rural in 2010
- Unitary urban consumption = 1.5 times rural beef consumption

the study estimated the demand for bovine meat at 24,435 metric tonnes in 1998 and potential demand in 2010 at 30,969.

Reference to Table 9 shows that the results obtained by KIT (30,969 metric tonnes) for 2010 are much lower than those of Doumbia and Metzel (40,556 metric tones). If we substitute the corresponding KIT values for those of Metzel *et al* in Table 9, we obtain a bovine meat demand index of 109 rather than 127 for 2010.

In this study, in conclusion, in order to evaluate the movement of the demand for bovine fatstock meat (urban demand + export), we shall apply the index 109 for 2000-2005 and 118 for 2005-2010 for bovine meat, thus averaging the two studies.

6. External Financial Support for the Sub-Sector

According to Koné and Sanogo (1997), around 60% of livestock fatteners are self-financing. This is certainly the case for the more dynamic operators found in Ségou and Banamba.

A certain number of financial institutions and NGOs are involved in the funding of peasant cattle and sheep fattening; this is particularly true of sheep fattening, as it is practised by women. Funding from credit institutions has risen from around 60M CFCA in 1991 to nearly 900M in 1995, and is thought to have exceeded 1.3 billion in 1998. There has been a striking increase in funding, attributable to the reputation of livestock fattening as a profitable activity.

7. Conclusions

The intensive livestock fattening market for ruminants is of relatively modest size in Mali. It currently comprises some 33,000 cattle and 117,000 sheep. It seems likely that this market will continue to grow at a rhythm of around 1% p.a. for the next ten years. Self-financing is the norm among the large-scale operators, who in general have mastered these problems more than adequately. But the small producers, particularly in supervised zones, are supported by institutional funding, particularly that of the Banque Nationale de Développement Agricole, and this funding is steadily growing.

The profitability of livestock fattening is good, though the risks relating to price fluctuations, particularly export price fluctuations, are not negligible. It is, however, closely tied to mastery of feed costs, which typically represent some 345 FCFA/day for ADG of the order of 800 g/day in cattle feed.

C. Sheep Fattening

1. Introduction

Sheep fattening corresponds to the recent development of so-called `hut sheep', the intensive fattening of one or more rams for the Tabaski feast-day. The activity is therefore badly structured and any consistent evaluation of it is difficult. However, it has recently acquired a new momentum thanks to the involvement of credit institutions funding feminine organisations that practise sheep fattening (PROFED in the CMDT zone, and the Commissariat des Femmes). And it is from this segment that effective demand for cattle feed for ovine fatstocking may emerge.

2. Population

The problems in effecting a census of sheep are very like those affecting the cattle census.

The fattening sheep population communicated for the 1998-9 year are given in Table 10.[21] Note that the population of sheep fattened in the Bamako district has fallen to a marginal level. In fact, it is only the portion of the business financed by the remaining ECIBEV credit.[22] The highest populations are again found in Ségou and Koulikoro. For the Gao and Kidal regions, no statistics are available. The total number of sheep fattened annually would therefore be around 117,116 head, rounded off to 117,000 (see Table 10).

Table 10: Current Ovine Fatstock Population According to DRAMR.[23]

Region	**Population***
Kayes	1,754
Koulikoro	23,096
Sikasso	12,844
Ségou	54,111
Mopti	22,992
Timbuctu	1,319
Bamako District	1,530
National	**117,116**

21 DRAMAR - DIRECTION REGIONALE D'APPUI AU MONDE RURAL (REGIONAL DIRECTION OF SUPPORT FOR THE RURAL MILIEU).

22 ECIBEV - ÉTABLISSEMENT DU CREDIT DE D'INVESTISSEMENT DU BETAIL (CREDIT ESTABLISHMENT FOR CATTLE INVESTMENTS).

23 SEE NOTE 21, PAGE 15.

3. Current Practices

The technical and economic characteristics of sheep fattening in the field have not yet been documented. There are figures available only for sheep fattening in controlled environments, and on these we must rely. Several studies have evaluated ADG for rams in a controlled environment. The results varied between 68 and 172g.[24]

Table 11: Results of Experiments on the Impact of Feed on ADG

Breed of Sheep	Initial Weight (kg)	Fattening Period	Feed	ADG (g)
Djallonké[25]	21	90 days	Green fodder: digitatia, Mucana + a concentr. Titrating 1 UF and 55g of MAD/kg raw material	88
Ram[26]	32	81 days	Brush straw, pterocarp. Leaves, millet, millet bran, ABH, Niébé tops	68
Rams Sahel sheep[27]	30	87 days	1.13 kg ration per day comprising 35% bourgou, 30% ABH	172

As to the duration of sheep fattening, it varies very little according to the experimental studies: 90 days (Doumbia, 1974), 87 days (Ballo *et al*, 1999). **We shall take 90 days as our reference value, and, in the absence of other references, the value of F48 daily expenses for an ADG of 133 g.**

For the last year, we were informed that average profits were 30-40,000 FCFA/head for sheep fattening.[28] According to profitability study performed in 1998 for USAID,[29] the average margin for sheep fattening, expressed in terms of net profit per

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24 See references in Table 11.

25 See Annex - Bibliography: Metzel *et al,* No 12.

26 Study performed in Banamba zone by Belier *et al*, communicated by the IER.

27 See Annex - Bibliography, Ballo *et al*, No 1.

28 Direction Regionale d'Appui au Monde Rural de Segou (DRAMR).

29 See Annex - Bibliography: Metzel *et al,* No 12.

animal day `fatstock unit' was 305 FCFA for sheep. This would a net margin of the order of 27,500 CFCA/head.

4. Evaluation of Current Feed Demand in Sheep Fattening

The current practices of sheep feeding and the duration of fattening are more various than for cattle. The animals are fed sometimes with brush straw, sometimes with crop residues, more rarely with hay from cultivated fodder. The periods of sheep fattening are generally determined by the feast day calendar. However, given the smaller quantities, and the very nature of the activity, distribution of a complete feed is more likely to gain acceptance here than in cattle fattening.

In order to render sheep fattening more efficient, two types of concentrate are proposed: starter feed, distributed as a supplement to brush straw, and finishing feed, given as a complete feed. These needs have been evaluated here according to the nutritive value of the concentrate envisaged and the performances expected of it.

For the starter feed proposed here, and for the duration of use envisaged, the ADG would be around 200g for an initial weight of 20 kg, and thus more than double those observed above in the same condition. The needs are of the order of 0.7 kg of concentrate to supplement 0.6kg of brush straw. For the finishing feed, the ADG expected is around 500g/j for the envisaged duration of use and an initial weight of 27 kg, thus constituting a still more spectacular improvement. The needs are of the order of 1.6kg/d of complete feed.

The traditional production objectives (ADG) cited above can be attained using various combinations of starter and finishing feed. We have chosen to fix the starter phase to 25 days, which would allow a weight gain of 5kg with the proposed starter feed. The finishing phase would then be reduced to 14 days with the finishing ration proposed. On these bases, the needs calculated appear in Table 12, followed by potential demand.

Table 12: Evaluation of the Need for Concentrates in Ovine Fatstocking

		STARTER			**FINISHING**		
Region	**Pop.**	**Needs Kg/day**	**Length Days**	**Total Needs (t)**	**Needs Kg/j**	**Length Days**	**Total Needs (t)**
Kayes	**1754**	**0.7**	**25**	**31**	**1.6**	**14**	**39**
Koulikoro	23096	0.7	25	404	1.6	14	517
Sikasso	12844	0.7	25	225	1.6	14	288
Ségou	54111	0.7	25	947	1.6	14	1212
Mopti	22992	0.7	25	402	1.6	14	515
Timbuctu	1319	0.7	25	23	1.6	14	30
BkoDistr	1530	0.7	25	27	1.6	14	34
Total	**11746**			**2059**			**2635**

Thus the current potential demand for a starter supplement for sheep fattening is estimated at around 2,059 tonnes per year, and for a finishing supplement at 2635 tonnes.

5. Market Development Perspectives for Sheep Fattening

Analysis of the future market for mutton from sheep fattening was conducted as above for cattle fattening (Metzel *et al*). There the hypothesis was that the movement of the fattening market would be proportional to the sum of domestic urban demand + exportable surplus of red meat in general. The urban demand changes with population growth rate on the one hand, and income on the other. As before, we have adopted the scenario we consider most likely,[30] that is:

- Urban population growth rate: 4.6%
- Income growth rate: 1%

This scenario gives the following results:

Table 13: Movement in Sheep/Goat Meat Demand (in CT*)

	1995	**2000**	**2005**	**2010**
Urban demand	11,843	15,196	19,209	24,030
Exportable Surplus	22,217	21,368	20,389	18,908
Total	34,060	36,564	39,598	42,938
Variation % Base 2000	**93**	**100**	**108**	**117**

***CT = Carcass Tonnes**

According to this study, urban demand for sheep/goat meat should increase by 60% between 2000 and 2010, while the exportable surplus would fall by 20%.

We now apply the methodology applied above for cattle meat by the KIT team (1 urban for 2.3 rural in 1998, 1 urban for 1.66 rural in 2010; unit urban consumption = 1.25 times rural consumption in sheep/goat meat). This sees annual urban demand for sheep/goat meat rise from 15,999 tonnes in 1998 to 25,889 tonnes in 2010, that is, a 61% increase.

In order to evaluate the movement in demand for fatstock meat (urban demand + export) we will apply the following indices:

- 2000-2005: 108 for sheep
- 2005-2010: 117 for goat meat.

30 SEE ANNEX - BIBLIOGRAPHY: METZEL *ET AL*, NO 12.

6. Financial Support for the Sub-Sector

The data available at the financial institution level is not for the most part categorised according to type of fattening, eg sheep/cattle/etc. The support for fattening in general, cattle or sheep, has been presented above (see Cattle Fattening, section `Financial Support').

7. Conclusions

The market for intensive sheep fattening in Mali is fairly modest. There are currently some 117,000 sheep. It seems likely that this market will continue to increase at around 1% per year over the next ten years.

Profitability is good in this activity, though the risk generated by fluctuating price levels, particularly for export, are not negligible. The key to profitability is however controlling feed costs, which are typically of the order of 48 FCFA/day for ADGs of the order of 130 g/day in sheep feed.

D. Dairy Production

1. Introduction

In 1985, a dairy policy was defined, and a milk-belt project for Bamako set up in 1989. This policy was relaunched several times; it was largely dependent on the ULB (Union Laitière de Bamako), which went bankrupt and was forced to close in 1993. The result was a major reduction in the peri-urban herd. A series of mini-dairies came into existence in the wake of the ULB bankruptcy; the devaluation of January 1994 favoured them relative to imported products, but they are now in steep decline.

Outside Bamako, certain private projects of modest size have come into being: KOSSAM MOPTI (currently 36,000 l/yr) and SÉGOU LAIT (75,000 l/yr). An NGO, the CIDR, has established three mini-dairies at Koutiala, Niono, San and Sikasso; between them they collect fractionally more than 200,000 l/yr.

The takeover of ULB by MALI LAIT in 1995 brought new hopes, which were quickly dashed, since this - prosperous - company bases its entire policy on imported powdered milk. It currently collects little local milk, thanks to an excessively low purchase price (currently 200 F). MALI LAIT has a particularly efficient commercial network and has seen its sales grow strongly; it currently reconstitutes 30,000 l of milk per day. The creation of SOLAIMA, which was due to start operating in October 1999, gives some ground for optimism, since it intends to use and promote milk of local origin.

2. Population

It is estimated that Bamako is supplied by collection over a radius of around 100 km. The dairy pool comprised 220,000 head in 1991, including

- 9,000 head for the Bamako district proper;
- 156,000 on the Kati circle;
- 55,000 head distributed among the three *arrondissements* of the Koulikoro circle and one *arrondissement* of the Kolokani circle.

The closure of ULB nevertheless resulted in a major reduction of the herd. **Current empirical estimates vary between 160,000 and 200,000 head; we shall adopt 180,000 as our reference value.**

On the basis of a population of 180,000 head, the most probable current population structure is shown in Table 14, and its composition in Table 15.[31]

Table 14: Corrected Structure of Dairy Herd (1999)

	Crossbreeds	**Zebu Maure**	**Others**
Total Pop.	6200	32800	141000
Category %			
Milk cows	18	28	20
Gestating cows	4	22	24
Adult males	5	2	6
Heifers	24	20	22
Young bulls	12	8	10
Calves	37	20	18

Table 15: Population of Diary Herd by Category (1999)

	Crossbreeds	**Zebu Maure**	**Other**
Category			
Milk cows	1116	9184	33840
Gestating Cows	248	7216	33840
Adult males	310	656	8460
Heifers	1488	6560	31020
Young bulls	744	2624	14100
Calves	2294	6560	25380
TOTAL	6200	32800	14100

31 ACCORDING TO THE 1997 CENSUS CONDUCTED BY THE PROJET DU DEVELOPPEMENT DE L'AGRICULTURE DANS ZONES PERI-URBAINES (PDAP).

3. Current Practices

In general, the periurban breeders are handicapped by the lack of land available for fodder crops. Few breeders grow such crops (graminaceae such as Panicum and Bracharia, and legumes such niébé and groundnut) in order to create haystocks for the dry season. During this season, most therefore confine themselves to distributing millet or sorghum straw, which is almost devoid of nutritive value.

The practise with supplements varies according to breeder, animal category and breed, Zebus Peuls and other small breeds often being the most neglected.

According to the IER diagnostic study of 1995, cited above,[32] the combination of millet bran + ABH (Aliment Bétail Huicoma) or ABH alone are the rations most commonly used. In other cases, millet bran alone is used.

The quantities distributed per cow in milk vary between 5-8 kg/day, according to its potential, which gives a share of between 0 and 8 kg of ABH. Some breeders distribute the supplement all year to the milch cows; others supply it only during the dry season. The rest of the herd invariably receives a simple maintenance ration.

According to different sources,[33] total production costs and thus feed costs per litre of available milk have following a rising trend in recent years. **We propose to adopt a norm of 100 FCFA expenditure on feed per litre of milk marketed, though this remains questionable, given the sale price of 250 FCFA/l.**

Quantities milked daily after removal of the calf, vary between:

- 3-6 litres for Zebu Maure and ¼ blood crossbreeds
- 1-3 litres for Zebu Peul and other local breeds
- 4 to more than 20 litres for ½ and ¾ blood crosses. However, for the latter, the weighted average observed by the PDAP is only 6 litres.

These observations and our interviews lead us to adopt for the three groups thus distinguished the standard daily production figures that follow:

Zebu Maure: 4 litres, other local races: 2 litres, crossbreeds with ½ or more blood: 6 litres.

In fact, only part of this milk is marketed. The PDAP studies have, in the past, shown that typology of the Bamako pool farms is complex, and practices variable. However, it would seem that the production marketing rate is between 50 and 75%. The results of these two hypotheses are shown in Table 16:

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32 COMMUNICATED BY THE PROJET DE RECHERCHE SUR LES SYSTEMES DE PRODUCTION RURALE (PRSPR, RESEARCH PROJECT ON SYSTEMS OF RURAL PRODUCTION), 1995.

33 THE PDAP STUDY OF 1994 GIVES 115-170 CFCA/L, WITH F50-100 ON FEED; THE DEBRAH *ET AL* STUDY OF 1995 GIVES 110-195 CFCA/L; A SECOND PDAP STUDY OF 1997 GIVES 187-205 CFCA/L FOR STABILISED HERDS.

Table 16: Daily Production Sold, Bamako Pool

	Crossbreed	Zebu Maure	Other	Total
Milk cows: pop	1116	9184	28200	**38500**
Yield/cow l/day	6	4	2	
Production L/day	6696	36736	56400	**99832**
Production sold T=50%	3348	18368	28200	**49916**
Production Sold T=75%	5022	27552	42300	**74874**

It appears that the total marketed today must be of the order of 50-75,000 litres/day, that is, an annual total of 18-25 million litres. This amounts to 15-20 litres/year/ person available in Bamako district.

Semi-intensive milk production is confined for the time being to the Bamako region; its development in other regions will go hand in hand with artificial insemination programmes. The milk produced and marketed in the other peri-urban zones comes essentially from local breeds.

According to the KIT study, the operating costs excluding feed can estimated as follows:

Table 17: Operating Costs (excluding feed)

Veterinary fees	10000
Transport of milk etc	20000
Depreciation	5000
TOTAL	**3500**

Sale of animals attains around 165,000 F/cow presented for crossbreeds, 10% less for ZM and 20% less for other breeds. The economic results per cow are summarized in Table 11:

Table 18: Products of Dairy Farms

	Crossbreed	ZM	ZP
Yield/yr/cow surveyed	1692	750	351
Ls milk sold/cow surveyed/yr	1269	563	263
FCA milk price/litre	250	250	250
Other products (animals sold)	165000	150000	135000
Av gross product/cow	**482250**	**290625**	**200813**
Feed costs	169233	74959	35068
Other costs	35000	35000	30000
Net margin/cow Surveyed	**278017**	**180666**	**135745**

The much greater profitability of crossbreeds is clear, despite the considerable extra feed costs. This is definitely the market niche in which the sector's future lies, as do the possibilities for developing industries upstream of it.

4. Evaluation of Current Feed Demand for Dairy Production

Here we consider only demand for feed supplements, which supposes that the demand for coarse fodder is satisfied. It should be noted at the outset that there is only a single valid local experiment result on which we can rely.

Thus daily feed costs for a cow in milk typically amount to F600 for a ½ or more blood cross, F400 for a Zebu Maure and F200 for other breeds. The corresponding annual expenditure is shown in the following table:

Table 19: Annual Feed Expenditure for Adult Cows (Bamako)

	Crossbreed	Zebu Maure	Other
Yield/cow (l/day)	6	4	2
Lactation period	290	180	160
Interval between calving (days)	355	380	400
Annual yield (litres)	1692	750	351
Feed costs (FCFA/yr)	**169233**	**74959**	**35068**

Taking the example of a ration in which ABH accounts for 80% of feed cost, the rest being made up of low cost millet bran and brush straw, and supposing the ABH can

be obtained at reasonable cost, say 50F/kg, it is clear that this would correspond to about a daily average of 7.5kg of ABH for a crossbreed during lactation.

Under current current periurban farming conditions, the calf is systematically left with the mother till weaned; its daily consumption must therefore be deducted from total production to obtain the milk total available daily. We estimated this consumption at 2kg/day on average.

The concentrate proposed here would be distributed as a supplement to brush straw. Brush straw needs are here estimated at 4.55kg daily, giving a round figure of 50F/day. Consumption would obviously be proportional to total production obtained; the relation of these is shown in Table 20. As to the expense acceptable to the farmer, we have seen that this is proportional to the available quantity.

Table 20: Maximum Sale Price for Diary Concentrate to the Producer

Daily Avail-ability (kg)	**4**	**6**	**8**	**10**	**12**
Daily Produc-tion (kg)	6	8	10	12	14
Feed cost norm (F/day)	400	600	800	1000	1200
Concent-rate cost Norm (F/day)	350	550	750	950	1150
Concent-rate Consum-ption Norm (Kg/j)	4.66	5.62	6.58	7.54	8.5
Max concent-rate cost (F/kg)	**75**	**98**	**114**	**126**	**135**

Table 20 clearly indicates that the maximum theoretically acceptable price would depend on the productivity of the herd. The crossbreed herd's average productivity can almost certainly be greatly improved (some cows have already supplied 20 litres/day or more); such improvements cannot be taken for granted in other breeds.[34]

34 RESULTS OF AN EXPERIMENT ON THE IMPACT OF IMPROVED FEED ON DAIRY PRODUCTION (PDAP).

This leads us to the conclusion that it would not be possible to justify on a feed conversion basis a dairy concentrate for most of the local breeds (Zebu Peul and others), but only with the Zebu Maure, which is generally considered a `good dairy cow' by Sahelian standards.

Only ZM and crossbreed populations (evaluated above) can therefore be taken into account as effective demand for the plant proposed. The quantitative evaluation will, moreover, depend on the average productivity adopted for these two populations. According to our hypotheses, the concentrate proposed here should make it possible to obtain (by 2005) an average of:

● 12 l/day, of which 10 would be marketable, for the half or more breeds (50% more than the current average);
● 8 l/day, of which 6 would be marketable, for the ZM and quarter or less breeds (25% more than the current average).

These hypotheses lead to the following evaluation:

Table 21: Market of `Lactation' Concentrate

	Crossbreed	**ZM**	**Total**
Pop. Milk cows	1116	9184	10300
Concentrate Consumption Norm (kg/day/cow)	7.54	5.62	
Concentrate Consumption (t/day)	8	52	60
Annual consumption (t)	**3071**	**18839**	**21910**

Here we propose a polyvalent supplement intended for the rest of the dairy herd (excluding sires and adult males) and could be distributed both to cows in late gestation and young animals (calves, young bulls and heifers). For a gestating cow, this supplement would be distributed at a rate of 4.3kg/j, supplementing 4kg of brush straw. The needs of young animals can deduced from the those of a gestating cow by the use of a coefficient. The coefficient adopted for young bulls is 1, for heifers 0.8 and for calves 0.66. The population data for crossbreeds and ZMs set out in Table 22 allow us to assess the potential total demand for this kind of feed.

It should be remembered that breeders currently distribute little or no supplementary feed to the herd, with the exception of lactating cows, during the rainy season, and confine themselves to a minimum during the cold dry season; indeed, they attend to the rest of the herd effectively during the hot dry season only. The cold dry season is thus an intermediate situation. To take account of this phenomenon, we have assumed that annual needs are equivalent to only six months of supplement.

Table 22: Market for `Dairy/Growth/Gestation' Concentrate

	Coefficient	Cross-breed pop.	ZM Pop	Consumption (t/day)	Consumption (t/year)
					(9 mths)
Gestating cows (4.3 kg/day)	1	248	7216	32	5857
Heifers	0.75	1488	6560	26	4737
Young bulls	1	744	2624	14	2463
Calves	0.66	2294	6560	25	4586
TOTAL		**4774**	**22960**	**98**	**17823**

We have no objective means of determining the sale price of the `growth-gestation' feed.

The PDAP study of 1994 made it possible to determine the rearing cost of a heifer as a proportion of milk production costs; on average this was F40/marketable litre. No data is available on the feed of gestating cows, young bulls or calves.

The maintenance feed proposed here is complete and is not a supplement to hay or brush straw. It is intended for sires and adult males, and perhaps for other categories of animal, such as plough oxen or animals in transit in a given farm.

It is difficult to define demand in these market opportunities. Plough oxen theoretically constitute a very large market niche (around 500,000 animals). However, the CMDT is promoting cheap rations based on crop residues, which will probably leave only an occasional market in this area on occasions when crop residues are insufficient.

The population of adult males in the peri-urban dairy farms can estimated at around a thousand head. This feed would have to be distributed at a rate of 3.4 kg/day, or 1250 kg/animal/year. The market for dairy herds would therefore be of the order of 1200 t/year.

In total, we can hypothesize, on highly empirical grounds, a minimum total market of 5,000 t for this kind of food.

5. Market Development Perspectives for Milk

The DNSI data indicates a total of 9,200 t of controlled imports of dairy products in 1996, that is, around 77,400 t of milk equivalents (almost exclusively cow's milk). If we take account of the 10% of further, non-controlled imports, the total would be around 85,000 t, or 85 million litres in 1998. 75% of this goes to urban consumption. This is essentially powdered and concentrated milk. These imports represent a cost of 11 billion FCFA.

As to domestic production of milk, according to the estimates of the KIT/IER team (late 1998), it comes to around 571 million litres of all kinds, breaking down into 316 million cow's milk, of which only 8% is marketed, ie 25 million litres.

The urban market, the only one that interests us here, should therefore have the following characteristics:

Table 23: Urban Consumption of Cow's Milk in 1998 According to KIT/IER (in millions of litres)

Consumption: imported	64
Consumption: local	**25**
Total	89
Urban population: Inhabitants	2.7
Theoretical availability: Litres/person/year	33
Reconstitution Cost of Whole Milk	208
Local Market Cost of Fresh milk	**250**

These estimates are concordant with the evaluation that we have set out above, estimating the Bamako local milk market at 18-25 million litres annually; the market in other towns is currently much lower.

The SOLAIMA project, with an installed capacity of 10,000 litres/day, expects to reach this average level of collection in its second or third year, amounting to 3.6 million litres/year, and representing 15-20% of the local milk market. This seems very reasonable, though the relative price hypotheses on which the project profitability calculations are based seem to us somewhat too optimistic.

The flexibility of income in Mali has been evaluated in various studies cited in the KIT/IER study; they range between 0.8 and 1.2. **We therefore adopt the reference value 1.** As regards the growth of income/inhabitant, we shall adopt the hypothesis selected by KIT as the most probable, that is, 1%/year. We similarly accepted the hypothesis adopted for urban population growth: 4.6%/year.

If reconstituted milk is not gradually substituted by fresh milk, the growth rate for the urban market is a product of these three factors, that is 4.6%. This would give **market growth of the order of 50% by 2010.** This may be considered a minimum. Of the three market opportunities considered in this study, the dairy sector therefore presents the most favourable outlook.

6. Financial Support for the Sub-Sector

As indicated above, financial development for the branch has always been based on state projects such as the livestock farm project, with its improvement of local breeds,

artificial insemination, marketing, etc. Recently the private sector, with its financial partners, has begun to invest more in the development of this sub-sector. The Union Laitière de Bamako (ULB) was privatised in 1995, and outside Bamako several smallish private projects have come into being, KOSSAM MOPTI (currently processing 360,000 l/yr) and SÉGOU LAIT (75,000 l/yr). CIDR, an NGO, has recently set up four mini-dairies in Koutiala, Niono, San and Sikasso, which between them collect just over 200,000 litres.

SOLAIMA was created in cooperation with a French operator (COOPEX, Montbéliard). Its factory is almost finished, and should commence operations in October 1999; its existence affords better prospects, since the factory intends to make use of and promote local milk. The Malian share-holders of SOLAIMA are thus said to represent some 700 breeders, notably through their dairy cooperatives (COLAIBA, CAPAC II, CAPES).

7. Conclusions

The high profitability of the activity, the very open market and the considerable technical progress margins theoretically make the dairy sector a promising market opportunity. However, the spread of progress, of which the essential element is artificial insemination, is and remains slow. Moreover, the breeder's attention is generally focused on the immediately productive animals, that is, the milch cows, to the detriment of the other components of the herd. The practice of correct feeding of the herd as a whole, which is, of necessity, relatively expensive, will require particularly intense educational efforts.

E. Summary of Conclusions

The market opportunity afforded by egg-producing poultry is clearly the most accessible in the immediate future for industrial feed. This demand was determined on the basis of 450,000 birds (according to the commercial concerns in the peri-urban zones). The sector boasts a fairly large core of professionals of good standard, who are aware of the need for balanced rations and careful to conduct their business in a rational manner. The profitability of the activity is proportional to the technical level of the farmer; it is excellent if the level is high. Despite a cyclical development characterised by periodic crises, the market will no doubt maintain its expansionary trend thanks to the growth of the urban population. The market analysis showed an annual growth rate of the order of 4-5%. The demand for poultry feed for egg-production is currently estimated at 16,000 t/yr.

The market for broilers is, for the time being, very marginal. But it should undergo very rapid growth in years to come thanks to the predicted substitution of red by white meat, since the production costs for white meat can be substantially reduced. However, there are many uncertainties hanging over this market, and it could be considered only as marginal activity in the evaluation of the demand for poultry feed.

The intensive ruminant fattening market is fairly small in Mali. It currently comprises some 33,000 cattle and 117,000 sheep. The sector offers satisfactory profit margins, though risks related to price fluctuations, especially for exports, are not negligible.

The key factor in profitability in both cattle and sheep fattening is mastering feed costs. This market will probably continue to grow at a rate of about 1%/year for the next ten years. The demand in cattle feed for this sub-sector was evaluated at around 15,000 tonnes/year.

The high profitability of the dairy sector, the very open market and the major technical progress margins theoretically make the dairy sector a promising one. The market tendencies are for 2%/year future growth. However, the spread of progress, of which the key element is artificial insemination, is and will remain very slow. The demand for dairy rations has been evaluated overall at 40,000 tonnes/year.

Overall the study has identified an effective annual demand for all types of cattle/poultry feed of around 71,000 tonnes, with an average rate of growth of 2-3% per year.

III. The Supply of Commercially Available Rations and Ingredients

A. Introduction

The supply of commercially available rations is very difficult to estimate because there is no formal, well-developed sector for the manufacture of cattle feed. Most producers make their own rations from locally available ingredients. Moreover, there is no systematic quality control monitoring at either producer level or at that of the small feed preparation enterprises. Nor is there any control of the quality of the raw materials. Consequently, the distribution of balanced rations to animals is a matter of chance.

Moreover, it is generally admitted that the lack of year-round adequate nutritional sources for cattle feed and fodder is one of main technical constraints on animal productivity. For the production of added value in this sector, the development of commercial enterprises manufacturing animal feed is a key and strategic factor.

In general, livestock farming in Mali is based on the use of pasture. The variable quality of the fodder and its seasonal availability mean that animal needs are covered for only three or four months in the year. The use of feed supplements rich in nitrogen allows breeders to make the most of the scant natural resources during the rest of the year. Feed supplementation is therefore a clear necessity, both in order to make up the food deficit and to obtain an acceptable level of production.

Further, the emergence of `semi-intensive' production systems oriented in particular toward feedlot operations, dairy and poultry production requires a level of daily nutrition which can only be met by high quality balanced rations and supplements available throughout the year. Currently the average commercial production of rations and industrial by-products for cattle and poultry is difficult to determine, but is estimated at around 100,000 tonnes per year.[35] This represents only 20% of the existing commercial demand (500,000 tonnes/year).

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35 SEE ANNEX - BIBLIOGRAPHY: MAIGA, NO 11, AND DIAKITE *ET AL*, NO 3.

B. Supply of Cattle Feed and Poultry Feed

There is no commercial industry for the production of a balanced feed for cattle or poultry in Mali. The commercial market for cattle feed in Mali is dominated by HUICOMA, a partly state-owned company which processes cotton seed into oil and oilcake in its Koulikoro, Koutiala and Kita factories. A by-product of this process, known as *Aliment Bétail HUICOMA* (ABH) is (by far) the leading cattle feed in Mali. It is made of oilcake, cotton seed hulls and salt in rather variable proportions. This feed is not a complete ration or supplement in terms either of its nutritive composition or a clearly determined production level.

ABH is relatively less expensive and more widely available than the other commercial animal feeds of the country. HUICOMA has monopoly in the production of this feed, since it is the only cotton seed processing enterprise in Mali. There are therefore difficulties with the distribution system. The society produces and sells around 80,000 tonnes of ABH per annum.

However, the reign of HUICOMA over the Malian cattle feed market is regrettable for two reasons. Firstly, feedlot operators rely more on the feed than on its guaranteed nutritional value. This excessive trust is demonstrated by the fact that other suppliers of cattle feed can produce feed of higher nutritional value at the same sale price as that of HUICOMA, and fail to sell their products. Secondly, HUICOMA's monopoly of the distribution system is designed to prevent the company from earning monopoly profits. HUICOMA is obliged to sell at a price per sack lower than the market price.[36] Consequently, rationing is required. This operates through a voucher system. There is consequently a substantial black market for vouchers and feed.

The black market effectively bring the price of ABH down to the free market price. A black market price is normally higher than on the free market, but this is not the case here; quite the contrary. This is because the production of ABH takes no account of the price of the product itself, but depends on the supply and demand on the cotton fibre market. Liberalizing the market will not therefore cause the supply of ABH to increase, as would normally be the case for other products, and the price will not fall.

In general, the real situation should not be too serious, inasmuch as the ultimate source of the difficulty lies in the fact that the supply of cotton seed depends above all on conditions in the cotton rather than the cattle feed market. However, two measures could significantly improve the effective use of the limited quantities of ABH on the market:

- reducing the quantity used by feedlot operators, who currently employ more feed than is economically advisable;
- increasing the use of high value animal feeds other than ABH. Many, perhaps the majority of these substitute feedstuffs use ABH or cotton oilcake as ingredients. But to the extent that cotton by-products represent only a certain percentage, generally less than 30% of the weight of the total ration, the quantities of ABH and cotton oilcake

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36 SEE ANNEX - BIBLIOGRAPHY: WYETH P., WASHINGTON STATE UNIVERSITY, *OP. CIT,* AND TIMBO *ET AL*, NO 18.

available will be still more thinly spread. Quality will not suffer, since the substitution feeds are generally of higher nutritive quality than ABH itself, whereas they cost no more than ABH does on the black market.

Another large company producing industrial by-products useful for cattle and poultry feed is the Grands Moulins du Mali (GMM). Based in Kouliko, GMM produces some 6-7,000 t/year of wheat bran commonly called *Aliment Bétail Achkar*, of which one third is exported. Like ABH, this feed is not a complete ration from the nutritive point of view, but wheat bran is an important ingredient in the formulation of balanced rations for cattle and poultry.

As regards poultry rations, most producers of semi-intensive units make their own rations out of locally available ingredients. Table 24 gives a list of enterprises (manufacturers) of cattle/poultry feed, most of which are in fact enterprises producing the raw material.

Table 24: Manufacturers of Ingredients for Mixed Rations And Cattle Feed

Companies	**Production Capacity (t)**	**Real Production (t)**	**Product Type**	**Remarks**
HUICOMA	106,000	77,000 - 95,000 (1992-4 downward trend)	By-products of cotton seed for ruminants	Industrial production
Grands Moulins de Mali (GMM)	12,500	7,000 av.	Cereal by-products for rumin-ants and poultry	Industrial Production
ALIMIX, Bamako	Currently and mixing	Supplies a service on	Composit-producer	Ion and demand.
Unité de Production Niono	1,482	N/a	Cotton and rice by-products for ruminants and poultry	Semi-industrial
COPRAAV, Ségou	2,350	1,250	Mixed rations for ruminants and poultry	Semi-industrial
EROCIF, Djicoroni, Bamako	3000	On demand	Cotton/ rice by-products for ruminants	Special feed formulae

For none of the feeds and rations currently used is there any quality control monitoring, either by small manufacturers or by producers. Nor is there any quality control of the ingredients (raw materials) on the market. Consequently, no one knows the exact nutritive value of the feeds or rations at any given moment.

C. Dry Cereal Supply

At national level, the production of dry cereals have followed a pattern of peaks and troughs since the beginning of the decade, as a result of climatic constraints. From one year to another, variations may be around 30%.

Sorghum represents on average 40% of total production and maize 15%. Beyond these year by year fluctuations, one can detect an underlying tendency toward significant increases in maize production; this is not true of sorghum, and millet production is clearly stagnating.

Thus we note that despite climatic variations, the available production of dry cereals in the CMDT zone has risen without interruption, in contrast with overall national production of dry cereals. It went up from 517,200t in 1993-4 to 836,700 t in 1997-8; this constitutes a production increase of 61.7% over five years and an annual average increase of 12.4%.

With rice, dry cereals are the staple foods of Mali. The peasant producers essentially produce for their own consumption and not for the market. Thus 10-20% of dry cereal production is subject to market exchange.

The production variations of around 30% noted between seasons as a result of climatic variation are obviously the main factor influencing the unstable prices of the cereal markets. Prices fall in times of abundance and rise dramatically in lean years. This instability obviously offers little incentive to the producers to produce for the markets.

At national level, the cereal balance for dry cereals, that is, the difference between available production (gross production - 15% of seed and losses) and domestic consumption (we exclude commercial imports - which are very low for millet, sorghum and maize, exports and food aid) was negative between 1990-91 and 1995-6, with the exception of the year 1992-3.

By contrast, in the CMDT zone, the balance for the same period remained positive throughout, even if we take into account the higher per capita consumption norms of this zone (214 kg/head in the CMDT zone, 168 kg for the rest of the country). The gross marketable excess is estimated at between 11 and 25% of available production (gross production minus 15%). The CMDT zone is therefore overall secure from a food perspective, since cereals represent the essential of the zone's calorific needs.

In the past, certain domestic animals received daily rations of cereals. The long years of drought with their accompanying food shortages have brought with them changes in mentality; it is now in poultry and less essentially in peri-urban dairy production that cereals, particularly maize, and their by-products, are used.

Currently Mali has no branch for the production and marketing of sorghum and fodder- or high-yield maize intended for animal consumption.

Forecasts for sorghum suggest the appearance of a surplus relative to human consumption needs on the national scale in the year 2000, even allowing for unpredictable climate. This surplus is expected to be of the order of 10,000 t in the first year, and thereafter to grow steadily.

For maize, again in the `with hazards' hypothesis, a surplus will be registered as of 2004. This surplus, of around 28,000t to begin with, should also grow steadily. Short of further climatic accident, Mali should already be producing a surplus. The overall prospects are therefore good.

Moreover, the regional directions of the CMDT in Mali Sud zone seem to be in no doubt about the capacity of their peasants to react to the existence of a reliable outlet; a rapid increase of maize production in their zones can therefore be expected. In the short term, and if rainfall is normal, a purchasing goal of 30,000 t of maize and sorghum thus seems realistic and practicable.

The price of cereals in the context of the takeover bid would have to be fixed at delivered to warehouse position, to facilitate reception and quality control operations.

By way of reference, OPAM bought millet/sorghum at an average price of 106.5 FCFA/kg delivered to warehouse in 1997/8 and 102.32 FCFA/kg in 1998/9. These prices are fairly high, due to a brief period of aggressive private sector competition. Thus, during the last growing year, contracts between OPAM and Ségou traders for the purchase of 9,200 t at Ségou at a price of 94,000 FCFA/t for the period 22 January-23 March could be only partially honoured, because Nigerian, Burkinabé and Mauretanian traders had meanwhile been buying at 109,000 FCFA/t.

It is the view of the head of the Agricultural Products Observatory (formerly SIM) that sorghum and maize can be bought in CMDT zones during the favourable period indicated above at a price range of 80-100 FCFA/kg at pool prices and 85-105 FCFA at delivered price.

D. The Supply of Industrial and Semi-Industrial By-Products

1. Rice bran

In recent years, the growth of paddy production has been steady and strong. Between 1990/91 and 1997/98, paddy production has risen by nearly 235%, an annual average growth rate of 29.3%.

Table 25: Paddy Production in Mali

Year	**90/1**	**91/2**	**92/3**	**93/4**	**94/5**	**95/6**	**96/7**	**97/8**
Prod. (t)	282, 400	454, 300	410, 000	427, 600	469, 100	462, 700	614, 000	663, 200

Production in 1998-99 is estimated at 728,400 tonnes of which nearly 72% comes from zones with total or partial mastery of water (irrigated cropping), especially in the Ségou and Mopti regions. These are the intervention zones of the Office du Niger (ON), the Office Riz Ségou (Région de Ségou), and the Office Riz Mopti (Région de

Mopti). The rise in paddy production is expected to continue to rise by an annual rate of 3-4%.

In the current study, the availability of rice for human consumption (rice cereal balance) is of less interest than the quantity and quality of brans that are produced with it. In Mali, there are two kinds of rice processing unit:

● On the one hand, the industrial processing units which produce calibrated rice to international standards and brans of a quality comparable with the above norms (of which a part corresponding to the last passage of the whitening cone is traditionally called `base flour'); only these brans can be input into the manufacture of industrial cattle and poultry feed.

● On the other, the artisanal units (using `Engelberg'-type hullers) producing uncalibrated `all and sundry' rice and coarse by-products (bran mixed with the rice husk) which are not fit for the manufacture of cattle and poultry feed. This kind predominates since the withdrawal of the Office du Niger from rice processing and marketing operations.

Industrial units in good working condition currently have a considerable paddy processing capacity, estimated at 128,000 tons in total. This represents a potential of around 9,000 tons of bran (on the basis of an average yield of 7%). Of these 128,000 tonnes, 120,000 are situated in the Ségou region, including:

● 100,000 in the Office du Niger zone, notably with SERIMA, which took over the former Office du Niger factories after their rehabilitation. These were: Molodo - 30,000t, Dogofri - 21,000t, Kolongo - 12,000 t and Denbugu - 17,000t.
● 20,000 t at Dioro in the Office Riz Ségou zone.

To this must be added 8,000 tonnes for the Grands Moulins du Mali factory at Koulikoro.

However, during the last two seasons (97/8, 98/9), these rice-processing factories have not been functioning. They processed a total of 35,000 tons of paddy in 97/8 and less than 10,000 tonnes in 98/99. This represents just 700 tonnes of bran of acceptable quality, including 280 t for GMM (immediately mixed with wheat bran) and 216 t for GGB at Dioro. **While this situation continues, the availability of rice bran to supply an industrial unit for the manufacture of cattle/poultry feed will remain uncertain, in which case it will be better to rely on wheat bran.**

2. Wheat Bran

The great majority of needs are covered by imports, the flour-making process being a monopoly of the Grands Moulins de Mali (GMM) at Koulikoro, whose mills have a capacity of 50,000t.

Because of the competition from imported wheat flower, the Grands Moulins has never attained full capacity. The quantity of wheat imported and processed at the Moulin has stagnated over the last few years and then underwent a sharp decline in 1998 in the face of competition from imported flour. To protect this industry, the

government recently approved a 25% surtax on wheat flour imports. It seems possible that this measure will lead to a new rise in production, the minimum objective being 10% annual growth. The GMM is hoping to reach full capacity, around 49,000t in 2002. If this objective were obtained, wheat bran production would reach around 11,750 t (24%).

The production of wheat by-products (bran and remillings) obtained from GMM over the last four years is as follows (in practical terms, the bran is not separated from the remillings):

Table 26: Production of Bran at GMM

Year	Wheat Processed	By-Product Output (bran and remillings in t)
1995	30832	7400
1996	30801	7392
1997	33434	8024
1998	24826	5958

The technical norms to be observed in mixing wheat bran and remilling are:

- raw protein: 14.8% minimum
- dry matter: 89% minimum
- raw fibres: 13% maximum

These norms seem to be respected in the present case. The ex works price of bran is theoretically 40F/kg, or 4,000F/t. However, during wintering, the greater difficulty of storing and falling demand force GMM to lower the price.

3. Cotton Oilcake

The totality of national production of cottonseed oilcake comes from HUICOMA's three factories: Koutiala, Koulikoro, Kita. The Koulikoro factory essentially produces pure oilcake, while the Koutiala factory produces a compound feed (ABH) containing oilcake, cottonseed hulls and salt in rather variable proportions. Kita produces an oilcake of `expeller' kind. Overall production over the last four years has been as follows:

Table 27: Production of Oilcake and ABH by HUICOMA

(Tonnes)	**92/3**	**93/4**	**94/5**	**95/6**
Cattle Feed	78000	64800	76000	78000
Oilcake	16200	13400	42300	67300

(Source: KIT/UE study, provisional draft)

ABH production, it will be seen, has been fairly stable, while the increase of oilcake production has been partly due to the Kita factory coming onstream.

Given the works currently in progress, as of late 1999, the Koutiala factory will have a processing capacity of 162,500 t of seeds, equivalent to 40,500 t of oilcake.

The capacity of the Koulikoro factory is 125,000 t of seeds, or 31,500 t of oilcake. Kita: capacity 50,000 t - 12,500 t of oilcake production. The potential total for oilcake production is therefore 84,500 t of oilcake, which would theoretically allow the production of 340,000 t of complete feed.

Theoretically, there is therefore no problem of availability, at least from the major factories (Kita produces an inferior product and suffers from its enclosed position). In fact, oilcake availability current poses grave problems. There are two main causes:

● The management of the factories is defective, which limits performance. Production at Koutiala has ceased, following a serious accident (6 May 1999) caused by the presence of residual hexane downstream of the de-solventiser. Koulikoro is running at 50% of capacity.

● More serious is the current marketing system. The market is not free. Because of the relative rarity of the product relative to needs, and the lack of competitive products, distribution is administered by a national commission that assigns quotas to privileged clients, such as the CMDT. The later is considered a priority since it represents the cottonseed producers. Other such clients are the OHVN and the APCAM (Assemblée Permanente des Chambres d'Agriculture du Mali).

The rest of the production is sold to private clients, breeders, but also traders, through issue of vouchers. This system gives rise to a series of forms of preferential treatment and speculation on the vouchers, which renders the final user price considerably higher. Moreover, between obtaining the voucher and delivery of the merchandise, a long and unpredictable delay can occur, forcing producers to limit their activities or produce their own unbalanced rations. **If this system remained unchanged, it would be necessary to negotiate a contractual quota with HUICOMA, in order to ensure the unit's supplies.**

The current price, VAT included, is F37,500/t ex works, not loaded, for Koulikoro oilcake. Kita oilcake is of mediocre quality and of lower price (F27,500/t). This abnormally low price does not really cover the complete production costs of a product whose market price in the sub-region is much higher (F67,000/t ex works at TRITURAF at Bouaké in the Ivory Coast). If this policy remains unchanged, it will be unfavourable to the marketing of quality feed competing with the oilcake and sold at a price reflecting its real cost.

4. Cottonseed Hull

The availability of cottonseed hull can estimated at 20,
000 t, coming exclusively from the Koutiala factory. This factory burns around 1/3 of its production of hulls to produce the steam necessary for the process (toasting and palettisation). The remaining 2/3 are normally incorporated into `AB' (Aliment Bétail - Cattle feed), the factory's single product. It is of variable composition and nutritional value. Note, however, that a marginal quantity is sold to breeders who fetch it directly from the factory.

The Koulikoro factory burns its entire production of hulls; it is equipped with a turbo alternator for energy production. There is therefore no surplus at Koulikoro as a rule. As to Kital, its enclosed position means that it is not, for the moment, economically viable to recover its hulls on a regular basis. The primary goal of the current policy of incorporating hulls in `Cattle Feed' is to be rid of a cumbersome by-product, rather than to optimize the nutritional value of the feed.

There is nonetheless a place for cottonseed hulls as a cheap ingredient for certain types of cattle feed (in the right proportions), such as in maintenance and finishing feeds, on condition the feed is granulated. It is an excellent vitamin and mineral support.

Granulation could also be performed separately. It is indispensable if the product is to be transported further than 25 km; the Koutiala factory, is, besides, very well equipped with granulating presses. Granulation cost might nevertheless prove an obstacle.

Currently, the sale price at the factory, non-granulated, and in relatively low quantities, is 10,000 FCFA/t unloaded. Here again it would be necessary to negotiate a quota with the Koutiala factory, which would therefore have to change its current policy of almost total incorporation of its hull production in AB.

5. Molasses

The sole supply source is Sukala, which currently manages two sugar-processing complexes of Chinese manufacture on the Ségou-Niono axis.

Sukala produces around 10,000 t/yr and currently markets a maximum of 1,000 t of molasses per annum; the rest goes into alcohol production. A large part of the quantity marketed, around 250 t, is sold to the CMDT, but molasses are also used by a large number of private breeders. The clients fetch the product from the factory or have it delivered by haulier. The molasses are packaged in 220 l barrels (around 280 kg) and sold at 12 FCFA/kg ex works.

Molasses availability is unproblematic. A commercial feed factory with a capacity of 50,000 t/yr would require on start-up between 1000 and 1,200 t of molasses for the production of a complete feed for dairy production and sheep and cattle fattening; these quantities would rise with the level of production planned thereafter.

6. Fishmeal

The Malian production of fishmeal, mainly used by poultry farmers, has till now been provided by the informal sector, in execrable conditions of hygiene. The main centre for the production of smoked fish is Mopti, whence it is sent to Bamako and other urban centres for human consumption. In the wholesale markets, at Koutialas and elsewhere, it receives a perfunctory sorting by eye. The reject fish is the raw matter

and is crushed to give a `fishmeal' with a high percentage of impurities and, above all, thoroughly contaminated.

However, some poultry farmers buy the fish whole, crush it themselves and mix it with oilcake. A no point in the chain is there a steam processing system, and so the fish is infested with salmonella, which therefore passes into the poultry feed. The use of this type of fishmeal would therefore constitute a real danger for a cattle feed industry.

Local production of fishmeal of satisfactory quality would require the establishment not only of a small industrial processing plant, but of a complete fresh fish supply network, with accompanying actions, such as education work among the fishermen. It cannot be envisaged in the short term in the context of the present project.

It is therefore indispensable, at least for the first few years, to be able to rely on an imported product. This would be a fishmeal substitute, with guaranteed:

- non-contamination
- 65% minimum raw protein content.

Consequently, incorporation levels of the fishmeal substitute in the various rations could be minimised, thus allowing the rations to be kept down to a competitive cost. It is proposed that AFPC containing 65% raw protein be imported from the USA. Its technical specifications are as follows

Raw protein 65% min
Fat 6.0% min
Raw cellulose 3% max
Humidity 6.7% max

Its current cost is evaluated at 216 FCFA/kg or 216,000 FCFA/t FOB in a US port, in 50 kg propylene sacks; to this must be added 45,000 FCFA/t transport cost to Bamako. Should the plant be permitted to enjoy the privileged regime of the investment code, the customs dues on a product of this kind would be just 6%. At start-up, the needs would be around 3,600 tonnes. Obviously, there would be no a priori availability problem.

7. Meatmeal

Meatmeal is currently produced by the Mali abattoirs, which are in the course of privatisation. They do not currently perform any other service than slaughter. The abattoir charges the client for slaughter, and the client retains the bones and skin.

However, the level of clandestine slaughtering has risen, while that of legal slaughters (abattoirs and slaughter floors) has diminished considerably. The recovery of blood invariably takes place under unacceptable hygienic conditions, and the result is thoroughly contaminated products. The quantities produced are insignificant (of the order of 2 t/year at the Ségou abattoir, for example).

To remedy this situation would require a complete rehabilitation of the abattoirs; a change in the production procedures would be required to create a reliable supply in Mali of blood and meat meal free of pathogens. True, a valorisation plant project for the 5th quarter exists at the Abattoir Frigorifique de Bamako (AFB); but here again, one cannot rely on local production. As of today, the effective date at which the service would come onstream and the effective quality of the product remain unknown.

It will therefore be necessary to rely on imported products guaranteed free of contamination and with guaranteed minimum raw protein content, at least to begin with. It is therefore suggested that blood and meat meal with specified 50% raw protein content be imported from the USA. The technical specifications would be as follows:

Raw protein 50% min
Fat 6% min
Raw cellulose 5% max
Humidity 10% max

This would permit a minimum level of incorporation in the rations, while keeping cost under control. The current price is estimated at 171 CFA/kg or 171,000 FCFA/t FOB US port, in 50 kg propylene sacks. To this should be added 45,000 FCFA/t transport costs to Bamako, and 6% customs dues under the same conditions as above. The first year needs can be estimated at around 4,500 t; there should be no a priori availability problem.

8. Conclusions

Overall, the availability in Mali of feed ingredients containing vegetable proteins, such as seeds, oilcake and grain-processing by-products is sufficient for the production of balanced feedstuffs at low cost. However, ingredients containing animal proteins, such as blood and meatmeal, and fishmeal substitute, will have to be imported, as will the mineral and vitamin supplements indispensable to the formulation of completely balanced feedstuffs.

IV. Profile of a Factory Manufacturing High Performance Poultry and Cattle Feed

A. Range of Products and Price

Products will be differentiated according to the target markets, principally poultry, dairy production and cattle fattening. We have defined ten products answering different needs in each of these segments; the list is not, however, exhaustive, but it is clear that this mix of products will very generally determine the profitability of the enterprise. All the feeds will be principally composed of elements of local origin:

- Maize, for which sorghum could later be substituted;
- oil cake and cottonseed hulls from the Koutiala and Koulikoro factories;
- Whole cottonseed, which the CMDT can supply;
- Wheat bran and/or rice bran, the latter if available.

1. Poultry Feed

The range will include:

- A `laying' feed with 16% protein
- A `pullet' feed with 18% protein
- A `chick' feed with 20% protein

Given the current paucity of the broiler market, we have not introduced a `broiler' feed in what follows, but there is nothing to prevent one being produced in the long run.

In this range of feeds, a large part of the protein content will be animal protein, which will have to obtained in the form of imported meals (fishmeal on the one hand, meat and bone meal on the other) at least for the first few years, until local supply sources of reliably high hygienic levels can be established in Mali.

The type of bran used here will normally be rice bran. The oyster shells used till now will be replaced by a combination of crushed limestone and dicalcic phosphates of natural origin (NTP), still used little if at all by local breeders.

Finally, the two kinds of supplement described above will be incorporated into these feeds, that is, a mineral rich in micro-elements on the one hand, and a vitamin supplement on the other; both will have to be imported.

2. Fattening feed

Four types of feed are proposed here: cattle and sheep starter and finishing feeds. The cattle starter feed is intended for animals `recovered' from pasture, and could equally be used for weaned calves. It would typically be used during the first thirty days of fattening and would allow a ADG of the order of 0.8 kg/day, which corresponds to the average currently observed in fattening cycle as a whole. Daily

need is estimated at 4.1 kg on average, supplementing some 4.2 kg of brush straw (see Ch II). It will be particularly rich in cotton oilcake, cotton hull and wheat bran.

The cattle finishing feed will be a complete feed in itself, distributed without brush straw, thanks to its significant cellulose content combined with a high proportion of whole cottonseed. Daily need is estimated at 9.2 kg. It is estimated that this feed will offer a considerable improvement over current performances (ADG = Average Daily Gain: see Ch II).

The sheep starter feed will be distributed at a rate of 0.7 kg/day as a supplement to 0.6 kg/day of brush straw for 25 days. This should permit a 5 kg weight gain. It will be rich in whole cottonseed, oilcake and cotton hulls, and wheat bran.

The sheep finishing feed will be distributed as a complete feed at 1.6 kg/day for the rest of the cycle. With this type of feed, a duration of 14 days (instead of 52) should be sufficient to obtain the average supplementary weight gain observed, i.e. 7 kg.

3. Feed for Dairy Production

Will include:

● a feed intended for cows;
● a feed for growth/gestation intended both for young animals (heifers, young bulls and calves) and cows in late gestation;
● a maintenance feed to be used for the adult males of dairy herds.

With the exception of the maintenance feed, all these feeds are designed as supplements to ballast composed of local natural fodder of mediWCRe quality, such as to obtain a ration of 13-14% protein for young and gestating animals, and 15% protein for milch cows. The maintenance feed will contain 19-20% protein.

The basic raw materials here are maize, cotton oilcake and wheat bran; the maintenance feed would further include cottonseed hulls. The growth/gestation feed is particularly rich in mineral supplement, and the dairy feed in calcium phosphate.

For the maintenance feed, daily consumption of 3.4 kg will allow an ADG of 0.68 kg in adult males. This feed could also be distributed not only to dairy herds, but also to `sundry' herds in transitional periods, and even to plough oxen. It is a complete feed.

4. Calculating Ex Works Prices

For our basic scenario, prices have been calculated relative to target prices to the livestock farmer. They have been calculated as below. Deducted from the target farmer price were:

● The costs of transport to the wholesale distributors: a unit cost of F30/t/km was applied to the Ségou-Bamako distance, giving a value of F7,200/t.

● The trader's margin. After discussion with professionals, we considered a margin of around 10% on the final sales price. Values have been rounded up or down.

Table 28: Feeds Proposed and their Factory Price

	Type of Feed*	Calculation of Ex-Works Price
1	`layer' feed: 16% protein	According to current mkt data (v Ch II), the target price to breeder proposed in the basic scenario is **F140 for all three feeds.**
2	`pullet' feed:18% protein	See `layer' feed above
3	`chick' feed: 20% protein	See `layer' feed above
4	Cattle starter feed	In the basic scenario, the transfer price to the breeder is determined relative to current daily expenditure. This is estimated at F345/head, including brush straw. 4.2 kg of brush straw at F10/kg = F42 expenditure, leaving F303 for the supplement. On the basis of a daily need of 4.1 kg of supplement, the maximum transfer price is F74/kg, which should be rounded up to **F75/kg**
5	Cattle finishing feed	● Short fattening period: 15 days are sufficient to `finish' the animal as against 30 currently. Current average expenditure is F345/day for 30 days, equivalent to F690 over 15 days. For consumption of 9.2kg, the max transfer price is therefore F75/kg ● Long fattening period: 26 days will `finish' the animal as against 50 days currently. Equivalent to daily expenditure of F663, or a max price of F72/j. These two values are very close; for the purpose of simplicity, we adopt **F75/kg**
6	Sheep starter feed	Current daily expenditure in sheep fattening is F4 for an ADG of 133g. Thus 38 days are required for a 5 kg gain, at a cost of F1824. If we deduct the cost of straw, i.e. F150 for 25 days, F1,674 remain available for the concentrate, or F67/day. The maximum transfer price is therefore F95.6/kg, which we should round down to **F95/kg.**
7	Sheep finishing feed	The equivalent daily expense during this phase is F178, which gives a maximum transfer price of F111, which we should round down to **F110/kg**
8	Feed for milch cows	The hypotheses adopted for the quantitative evaluation of the market correspond to a daily

		average production of: ● 12 litres for the half or more breed crosses, corresponding to a daily consumption of 7.54 kg. Current daily expenditure for this production level is estimated at F950 (10 x F100 - straw price, i.e. around F50): on this hypothesis, the maximum transfer price to the breeder comes out at 950/7.54 = F126. ● 8 litres for the ZM herd and quarter or less breed crosses, which represents practically 9/10 of the target population. Here the daily expenditure is not more than F550 for a consumption of 5.2 kg, giving a transfer price of F98 only. Of course, a single price is required. In the basis hypothesis, we tested a price of **F110/kg**, which would be very attractive for the crossbreed breeders (a priori the `leaders') and an additional cost of only 12% for the others.
9	A growth/gestation feed intended for heifers, young bulls, calves and cows in late gestation	Daily needs are estimated at 4.3 kg for a cow in late gestation plus consumption of 4 kg of brush straw. These needs will be identical for young bulls; for heifers, they would be around 3.2 kg/j and for calves 2.84 kg/j. Price determination is particularly delicate here: there are no reference data. But the price cannot exceed the dairy feed, for obvious psychological reasons. In our basic hypothesis we tested the transfer price of **F105/kg**. The cost of daily rations, straw included, then comes to: ● gestating cows, young bulls: F491 ● heifers: F384 ● calves: F340
10	A maintenance feed to be used by adult mails in dairy herds and others	There are no reference data for objective assessment of a transfer price. However, again for psychological reasons, the price must be low, below those of fattening feeds. In our base hypothesis we tested the price **F70/kg**. The daily ration then comes out at F238.

* See Annex II for formulation of proposed rations

B. Marketing and Distribution System

We shall here consider the following aspects: target clientele, commercial structure to be established, commercial promotion, popularization of the products, and sales systems.

1. Target clientele and distribution network

The target clientele is essentially made up of intensive and semi-intensive peri-urban farms in the segments poultry, livestock fattening, and dairy production. To these should be added peasant farms for animal production (eg peasant livestock fattening) supervised by rural development structures such as CMDT, OHVN, Office du Niger, and certain NGOs.

However, sales will be conducted not directly to the producers, but through a network of distributors; this should combine lower distribution costs and greater efficiency. Thus private distributors will be authorized on the basis of one or two per locality (for example: Bamako, Banamba, Ségou, Koutiala, etc) and selected for their professionalism.

Bamako is the most important target market. A deposit of useful stocks should be constituted there to avoid stock-outs at the client level or distributor-deficiencies.

2. Commercial Structure

The commercial structure will comprise:

● A Sales Manager based at headquarters. He will be responsible for execution of commercial policy and strategy, supervision and control of agents placed under his authority (sales technicians, stock controller) and administration of sales.

● He will be assisted by a secretary

● A stock controller: he will be responsible for the management of the Bamako warehouse, and shipping and re-supply for clients in this zone.

● Four sales technicians who will be qualified as both animal technicians and marketing specialists. They will be divided among:

- ● BAMAKO: two sales technicians: one for Bamako District, which is by far the most important target market, given the level of development of the periurban farms, and one for the Koulikoro and Kayes regions.
- ● SÉGOU: one sales technician, who will cover the Ségou and Mopti regions.
- ● SIKASSO: one sales technician responsible for the Sikasso Region.

Each sales technician will be responsible for research and monitoring of clientele, the popularization of the products manufactured, the conduct and monitoring of demonstration tests and the development of the sales force. He will maintain close contacts with the supervisory structures such as the CMDT, Office du Niger, OHVN, and NGOs, in order to make the feeds known and popularize them.

3. Commercial Promotion

A package of complementary actions and techniques will be applied to ensure acquaintance with and diffusion of the products:

● **Media publicity: Radio, Television, newspapers**

According to the estimate of the Agence Malienne de Presse et de Publicité (AMAP), the cost of an intensive publicity campaign lasting one month on the various media would come to:

● **Television:**
production (sketch and support ad): 2,300,000 CFCA
broadcast (sketch 10 times, support ad 24): 5,000,000 CFCA

● **Radio**
production of ad in French, Bambara and Peulh: 60,000 CFCA
broadcast 60 times on each of
2 state radios and 4 private radios: 1,600,000 FCFA

● **Presse**
technical fees: 150,000 FCFA
advertising space in:
National Daily and 4 private papers: 1,750,000 FCFA

● TOTAL: rounded off to:11,000,000 FCFA.

An annual publicity effort corresponding to three months intensive campaigning (in particular during the dry, hot season) is planned, thus **36,000,000 FCFA.** A special effort will also be made at the start-up of the enterprise.

● **Taking part in the trade fairs and exhibitions of the cattle meat sector**

Participation planned for the following:

● the annual trade fair of the Mali Chamber of Commerce and Industry (Bamako)
● the annual trade fair of the Assemblée Permanente des Chambres d'Agriculture du Mali (Bamako)
● the annual trade fairs of the regional Chambers of Agriculture of Ségou, Sikasso and Mopti.

The cost of hiring and fitting out a stand are estimated at around F300,000 and staff costs at around F200,000 for a week, making a budget of F500,000 per trade fair, ie **2,500,000 FCFA annually**.

● **Organisation of workshop-seminars**

The objective of these seminars will be information and awareness promotion, training, and collecting the observations of professionals from the target segments on the subject of animal nutrition in relation to the products manufactured by the plant. A one-day workshop-seminar will be organised annually at Bamako, Ségou, Sikasso and Mopti. Rental of premises is estimated at 150,000 FCFA x 4 = 60,000C FCA, + transport costs for two seminar leaders (the Sales Director, and a sales technician) and an animal nutritionist at 1,250,000 FCFA. This therefore requires a provision of **2,000,000 FCFA per year**.

Periodic promotional sales of the enterprise's product will be organised for a representative sample of the target clientele in the market niches targeted, lasting a fixed period (eg cattle fattening 3 months, dairy cow 4 months, pullet 1 month, layer 2 month, etc.)

The products will be sold to the farmers in question at promotional prices well below normal levels, in order to encourage them to try them. Those who benefit will be subject to close technical monitoring. The results will be quantified and broadcast through the press (radio, TV and papers) accompanied by the farmers' remarks in the form of reportage and documents which will highlight the comparative advantages of the plant's feeds.

The budget to be assigned to this operation corresponds in reality to money lost on sales. We have adopted a figure equivalent to 1% of the total average cost of the raw materials for the first three years, that is: **10,000,000 FCFA**.

C. General Design and Cost of the Production Unit

1. Choice of Site for the Factory: Criteria and Results

The problem of where to site the factory is fundamental in the determination of investment and operating costs. Visits in the field and the information available to us led us to consider five different localities: Bamako (on the Bamako-Koulikoro axis), Ségou, Sikasso, Koutiala and Kita.

For each of the five places, we considered a series of criteria which would appear to affect the chances of success of the project. For each criteria considered, we gave a score between 1 and 5 to each locality. Five criteria were considered essential, and were therefore given a coefficient of 2. These are:

- Proximity of agricultural raw materials (maize and perhaps sorghum)
- Availability of a regular and reliable energy source

- Availability of sufficient quantities of water
- Accessibility
- Availability of a storage capacity that could be hired to supplement the capacity of the factory

Three other criteria were considered:

- Proximity of one of the two HUICOMA factories producing oilcake of sufficient quality (Koutiala and Koulikoro)
- Proximity of factories likely to supply brans (wheat or rice: GMM, Dioro, Niono)
- Importance of proximity to the market in the three niches targeted (poultry, dairy, fatstocking)

These criteria are summarised in Table 29.

Table 29: Elements in the Selection of a Site for the Factory

CRITERION	Coefficient	Bamako/Koulikoro	Ségou	Sikasso	Koutiala	Kita
Prox. Cereals	2	4	8	10	10	2
Prox. Oilcake	1	5	3	4	5	2
Prox. Brans	1	5	4	2	3	1
Local Poultry Mkt	1	5	3	3	3	2
Local Dairy Mkt	1	5	3	3	3	1
Local Fattening Mkt	1	5	5	3	3	1
Avail. Electricity	2	10	10	2	2	3
Avail. Water	2	10	10	2	2	3
Accessibility	2	10	10	5	5	2
Avail. Storage	2	10	10	2	3	1
TOTAL		**69**	**66**	**36**	**39**	**18**

These results speak for themselves, and leave the question of whether the plant should be built at Bamako or Ségou open. However, certain factors speak in favour of Ségou, in particular:

- Its very central position makes it easier to serve the North and East zones of Mali, in particular, Mopti;
- Supplying a factory situated north-east of Bamako, on the Koulikoro road, would require lorries to cross the town, causing operational difficulties and cost overruns.

We therefore realised the study on the basis of a factory situated at Ségou, with the corresponding approach costs.

2. Production Capacity

This is a modular plant of 50,000 t annual capacity, which will allow at least 40% coverage of the various markets evaluated in the Annexes B, C and D.

The theoretical capacity is 20 t/h in ideal conditions. It should be borne in mind that the sizing of the unit is based on an 8 hour working day during 260 days of the year. It is always possible to go over to two and then three shifts according to demand.

The principal components of the mill are storage, receiving department, milling, mixing, granulation, packaging, civil engineering, electric and mechanical equipment.

3. Receiving department

There will be two receiving areas:

- The first intended for receiving grain in bulk, eg maize and sorghum

  An automatic probe will extract four samples per lorry and will send the samples via a pneumatic system to the laboratory to test the grain received for humidity and impurities.

  The lorry will then pass a weigh bridge of 60 t capacity, with digital display and automatic print-out of a weight ticket.

  Then it will go to the receiving tank, where it will be tilted by a hydraulic system allowing the truck's contents to be tipped out, even if it has no tipper system.
  The grain will be removed at a throughput of 125t/hour by a bucket elevator, which will take it close to the storage cells.

- The second receiving zone will be a horizontal storage warehouse, backing onto the mill and intended to receive the inputs in sacks: brans, meat and fishmeal, calcium phosphates and pre-mixes.

The cost of the receiving equipment ex works is US $163,508.

4. Storage

The bulk storage system will consist in:

- A bucket elevator of 125t/hour capacity, which will discharge the grain onto a cleaning-separating apparatus, to eliminate impurities whose diameter is lower than that of the grain. A large part of these impurities

will later be reincorporated into the feed, since they are generally an excellent source of proteins and of easy digestion.

- A battery of cells in corrugated iron of 16.5m diameter and 81.7m height, with a capacity of 3552m^3 or 2550 tonnes, representing a total capacity of 15,000t. Each cell will be equipped with six aeration vents, two centrifugal ventilators of 3 hp, and a complete evacuation system, including a scraping screw with conical base. There will also be thermometers.

The cost of the storage equipment, ex works, is US $440,665.

5. The Mill

It will be of modular type. The grain will be received in buffer-cells via conveyor chains and bucket elevators. From there, the grain will be discharged into a hammer grinder with a capacity of 18-22t/hr.

There will also be a series of 20 cells for the different inputs, each with a capacity of 22t, situated above a bulk rocker that will discharge spontaneously into a ribbon mixer with a capacity of 2t.

The manufactured rations will be sent into a series of raised cells before being placed in sacks and shipped or stored in sacks in a warehouse of 2000t capacity.

The finished product can also pass through a molasses mixer or a fat injector, as the ration needs dictate.

From there, the product will be able to pass into a granulation press of 20-22t, then into a cooler, and (poultry feed only) a crumbing machine.

The granules can then be sent either into four overhead storage cells, or directly into one of the two en-sacking lines.

The factory will be equipped with an automatic control system with the corresponding indicator board and a computer that can be programmed to effect all the ingredient mixes necessary for the given formulation.

The mill equipment cost is US $1,984,787 CAF Abidjan.

6. Recapitulation of the Cost

The estimated key-in-hand cost of this plant, set-up and ready to go is recapitulated in Table 30, which takes account only of fixed assets.

To this should be added 21,000 FCFA for spare parts.

Given their solidity, the equipment will be depreciated over 15 years, and the buildings in classic fashion over 20 years. Depreciation is straight line.

Table 30: Cost of the Production Unit

	US $*	X 1000 FCFA
20t/h Mill, CAF Abidjan	1,984,787	1,190,872
Set-up and wiring	555,740	333,744
Storage + handling 15,000MT	604,173	362,504
Assembly and wiring	151,200	90,720
Civil engineering	325,300	195,180
Training and start up	125,000	75,000
Freight and insurance	185,000	111,000
Total, shipped and set up at Ségou	**3,931,200**	**2,358,720**

* Exchange rate = 600 FCFA/$

D. Inputs: Purchase Costs and Direct Margins

1. Maize

Maize will have to be bought and stored as early as possible in the season, that is, in the period October-December. In the assessment of Working Capital Requirement (WCR), the requirement for storage equivalent to 270 days of consumption has been provided.

In this period, according to our discussions with specialist operators who buy in great quantity from the small collectors, if the harvest is good, the price of a kilo of maize delivered to Bamako in polypropylene sacks of 100kg, unwinnowed, comes to 85F (includes 5F transport). Transport costs vary with the destination town, since the grain must be transported from one region to another; in this case it comes principally from Sikasso.

Account must be taken of the average rate of impurity, which is 5% minimum in the CMDT zone: the reference cost must therefore be raised by that amount.

We have adopted as our reference price F90, noting that it is imperative that maize or possibly sorghum be bought between October and December if this value is to be applied.

2. Cotton By-Products

As regards oilcake, the current price, tax free, at the oilcake factory, is F3,500/t; this is an administratively determined price, and represents an under-evaluation relative to the regional price. It will no doubt be possible to negotiate a large quota at this price with HUICOMA if the current policy of administrative determination of prices and

volumes continues. This price has nevertheless been adopted in our basic scenario, since it corresponds to the current situation.

If sales were liberalised, which seems inevitable over the next few years, the reference price adopted should be a regional reference price. We have agreed to take as reference the prices applied by the TRITURAF factory at Bouaké, that is F6,7000/t delivered to the factory floor.* Koutiala-Bouaké transport costs must therefore be subtracted from this price, on the basis of 30/t/km. It is thought that, in the new UEMOA context, no customs dues will be levied. The distance Koutiala-Bouaké is 750km, thus giving an ex works price at Koutiala of F44,000/t.

Whole cottonseed is currently sold to HUICOMA by the CMDT at F11,000/t delivered to the factory floor. To this should be added F5,000 of transport costs. The reference price is therefore F16,000, which is the price adopted in the basic scenario. However, this too is an administratively determined price, which is quite unconnected with the reality of the regional market. Thus, a study conducted during the EAGER project evaluated the current market price of cottonseed as around F30,000/t, on the factory floor.*

When they are neither burned nor incorporated into AB, cottonseed hulls are currently sold to farmers by the Koutiala factory during the transition period at F10,000/t; we had adopted this as a reference value.

3. Other local Ingredients

Wheat bran is normally sold at F40,000/t on the factory floor at Koulikoro; to this must be added around F5,000 transport costs to Ségou. It seems possible to obtain reductions for bulk orders, so we have adopted a slightly lower value: F37,000/t.

Rice bran: this must be industrial bran, and not the byproduct of village rice-processing, which would be of no value to the project. This year, rice bran is sold at F50,000/t ex works at the DIORO factory. Given the rarety of the product, we have adopted this price. Transport costs are low here, around F2,000/t.

Tri-phosphate or NTP (Natural Tilemsit Phosphate) is delivered to Bamako at the price of F75,000/t. We have adopted this reference value for Ségou too.

4. Imported Ingredients

The animal meals obtained from American suppliers CAF Abidjan are:

- Fishmeal US $392/t, or F235,000/t
- Meatmeal US $317/t, or F190,000/t

To this should be added around F46,000/t overall cost for shipping to Abidjan and Abidjan to Bamako. If the project were accepted as falling within the privileged regime of the investment code, a hypothesis we consider here, the customs dues would 6%. The reference values are therefore F295,000 and F247,000/t respectively.

The mineral supplements (`premix') are evaluated at US $642 shipped to Bamako, to which 6% customs dues should be added (as with the animal meals), making a final cost of US $408,000/t.

The vitamin supplements are evaluated at US $5358/t at Bamako, plus 6%, giving a final cost of 3408 FCFA/kg.

5. Other Inputs

A single type of packaging has been included in these costs: the 100 kg polypropylene sack at F340/unit. The evaluations concern a factory operating `all electric' all year round. The factory will be equipped with generating equipment to be used exclusively if the electricity supply should fail. The cost of electricity is 94 FCFA/Kwh. Electricity consumption has been fixed at 12 kwh/t, whatever the feed kind.

6. **Determining Purchase Prices** and Direct Margins

The direct cost of production have calculated for the range of ten products proposed, as described in paragraph 3, on the basis of balanced rations optimized with the aid of the University of Missouri. Only inputs have been taken into account here, and no budget allocation has been made for labour costs or of product by product depreciation costs.

E. Other Investment Items

1. Other Tangible Assets

The budget items `buildings and fittings' and `technical installations' have been described above. The other investment items in the present case are:

- The site: The price/m^2 at Ségou is F3-4,000/m^3. The area necessary would around 1.5 hectares. Provision of 50M FCFA has been made, plus 20M CFCA for introducing water and electricity supplies.

- Vehicle park: Transport of raw materials and finished products, including from the factory to the Bamako depôt, will be subcontracted to private hauliers, so the no heavy vehicles will be required.

However, provision must be made for:

- Four vehicles for the sales technicians responsible for the various zones;
- Two liaison vehicles, with two drivers, to be available to the general management and department heads.

All six vehicles should be four-wheel drive in order to be able to get around the country at all times of year. Their maintenance will be subcontracted, so no garage is provided. The cost of this type of vehicle is evaluated at 30M CFCA before tax. This item therefore requires a provision of 150M FCFA. Conditions in central and south Mali are of average difficulty, and they will be depreciated over four years.

The office hardware will be reduced to a minimum, the most expensive items being micro-computers. Each department head will have his own, as will his secretary. The warehouse keeper will have a further computer, and one will be available to the sales technicians when they come to the plant. Therefore some ten machines should be provided for, at a price of 1.5M FCFA/unit. Given the other items to be provided (offices, etc), provision for this item will therefore be 20M FCFA.

2. Intangible Assets

These will be limited to the cost of the constitution of the company and the publicity campaign for its launch. No investment in R&D, prospection, acquisition of patents or businesses is envisaged.

The cost of the constitution of the company, according to the estimate provided by a notary, are the costs for registering the constitution of a company with a capital of 1 billion FCFA, that is:

- notary fees: 8.5M FCFA
- Others (registering fee, publicity): 128,500 FCFA.

Provision of 9M FCFA has therefore been made.

As regards the publicity campaign for the launch, it was decided that this would simply be double the ongoing publicity effort specified, whose cost is evaluated above at 36M FCFA.

3. Initial Working Capital Requirements

The Working Capital Requirement (WCR) is determined by the sum Stocks + Clients - Suppliers. The hypotheses taken into account are detailed below:

The duration of storage to be planned depends on the raw material in question. The hypotheses chosen are as follows:

- Maize: It is essential, as we have seen, to buy maize between October and December if it is to obtained at the lowest price; a stock equivalent to 270 days of consumption should therefore be acquired.
- Rice bran: the season lasts 6 months, 180 days consumption must therefore be provided for.
- For wheat bran, by contrast, and for the oil-processing by-products, which come from factories working continuously, a consumption of 15 days is theoretically sufficient.
- For local mineral substances (crushed limestone, NTP), which are also in continuous production, this provision should be one month.
- For imported inputs (premix, vitamin supplements, fishmeal, etc.), given their more complicated logistics and the possibility of incidents, the provision should be 2 months.

The evaluation of the materials being processed in manufacture and stocks of finished products have been made according to the production cycle. The production cycle is

rapid; the inventory should therefore be one day of production. In order to cope with possible demand peaks, the stock of finished products, in all categories of feed, should be 30 days sales.

The evaluation of the items `clients' and `suppliers' has been made according to the distribution policy, which rests on network of private traders. There will therefore be no direct sales to livestock farmers. Since the option chosen for these clients is cash sale, without credit, the `clients' item is void.

The purchase of grain/seed will be from the same type of trader, who will, according to the same logic, have to be paid in cash. There will therefore be no lead time under the heading `suppliers' in regard to cereal purchase. By contrast, it is expected that the local industrial suppliers - HUICOMA, CMDT, GMM and the phosphate and limestone extractors - will offer average terms of 30 days. The imported products will have to paid for as cash purchases.

F. Personnel and Organisation Chart

1. Organisation

We propose the following organisation:

● The technical management of the company will be based at the factory, that is, in Ségou.
● The overall management, that is, sales and financial management, will be based in Bamako. This presents many practical advantages for this level of management, including proximity to the decision centres for the main suppliers, and the determining influence of the Bamako market, which accounts for at least 2/3 of the national market. The company will also have a warehouse at Bamako.

The factory manager will be assisted by two foremen, one of whom will work nights, in particularly on the granulating press, and an electrician-mechanic in charge of routine maintenance tasks. The factory will be provided with an office and a secretary. It will have eight workers, four of them employed to pack the product in sacks.

The sales director will supervise four zone officials, two of whom will be based in Bamako (North and South-West zones), one at Sikasso (South zone) and one at Ségou (East zone, including Mopti), and the Stock controller at Bamako, who will have a regulating role in the delivery of products to clients. The sales department will have one secretary.

The financial director will in charge (among other things) of management of supplies. He will be assisted by an accountant and a secretary. The general management will also have a secretary. There will be two drivers for two 4x4 liaison vehicles (each zone official will have his own 4x4) and an orderly.

The enterprise staff will total 28 persons.

2. Costs

Gross salaries (including employer contributions) have been calculated on the monthly bases indicated in the following table:

Table 31: Staff Remuneration

Post	Numbers	Gross monthly salary
General Manager	1	900,000
Departmental Managers	3	460,000
Foremen	2	90,000
Electrician-Mechanic	1	170,000
Accountant	1	170,000
Stock controller	1	80,000
Sales Technicians	4	170,000 (+ bonuses)
Secretaries	4	60,000
Workers	8	50,000
Drivers	2	50,000
Orderly	1	35,000

The employers welfare costs have been evaluated as follows:

The following rates have been applied to the total gross monthly salaries of the staff:

= industrial injury: 4%
= family income support: 8%
= pension (employer's share):3.4%
= health insurance: 2%
= disablement insurance: 2%.

Bonuses will be granted to the four sales technicians according to their sales results. Here an average motivating value has been planned, equivalent to twice the basic salary.

The payroll thus amounts to almost 80,000,000 FCFA in the first year, including bonuses and employer welfare costs.

Taxes and employer contributions on the salaries have been calculated applying the following rates:

- *Taxe office* - workforce: 1%
- Flat-rate contribution: 7.5%
- National Housing Fund (FNL = Fonds National de Logement): 1%
- National Federation of Malian Employers: 1%

The annual taxation on remuneration thus comes out at 5,000,000 FCFA p.a.

G. Other Structural Costs

1. Transport and Travel

Besides salary costs and bonuses, we also take into account significant travel costs. On average a salesperson will cover 500km/week and spend 3 days/week away from home. The daily allowance supposedly being fixed at F30,000, one could consider a provision of F100,000/week in travel expenses, plus one hundred litres of petrol and various maintenance products (oil, etc), or a supplementary provision of F50,000. On the basis of a 40-week year (excluding holidays, seminars, trade fairs, etc.), the overall cost of this item comes out at **24,000,000 FCFA.**

In addition to the trips of the sales technicians, travelling between Bamako and Ségou will often be necessary. On the basis of 2 return trips per week for two persons, its cost can be evaluated at 200,000 FCFA: 100,000 FCFA in petrol, and 100,000 FCFA in daily allowances and other expenses. The annual cost then reaches 10,000,000 FCFA, which should be added to the sales trips. Taking account of other, occasional trips, the item is evaluated at 40,000,000 FCFA.

2. Rent

We have seen that it will quickly become necessary to rent storage space at least for part of the year in order to ensure production growth and be able to buy maize in particular at the best price. The cost of renting different OPAM warehouses comes out as follows:

Table 32: Rent of OPAM Warehouses

Place	Available Capacity (tonnes)	Cost/tonne/month in FCFA
Bamako	20,000	350
Ségou	17,500	140
Sikasso	2,700	190
Koutiala	3,000	130
Bougouni	1,800	130

As can be seen, the unit costs vary considerably with locality. Ségou warehousing is obviously the priority for the enterprise. 15,000t storage for 6 months would cost 14,700,000 FCFA. An annual provision of 15,000,000 FCFA has therefore been made.

3. Insurance

A wide variety of risks can be covered by industrial insurance: fire-explosion, third-party, riots, theft, etc.
The risk of theft is considered small given the presence of guards, and riots and political risks are thought negligible.

The unit must in any case be installed on a site properly distant from neighbouring units, so we have allowed for coverage only of fire and explosion, which are real risks in this kind of industry. The annual premiums payable in this case represents 1.36% of the value of the buildings and equipment (US $4M), or 3,260,000 FCFA before tax.

4. Fees and Other Management Expenses

The fees of an auditor are 1,500,000 FCFA on average. Fax, telephone and courier expenses are estimated at around 700,000 FCFA per month, or 8,400,000 FCFA p.a. Banking costs for current account operations can be estimated at 3,000,000 FCFA/yr.

5. Taxes and Duties

Taxes on remuneration have been noted above. Since the company will not be hiring its buildings, it will not be subject to any property tax. Trading licence is normally 1,250,000 FCFA for a turnover exceeding 1 billion FCFA; however, regime B, if awarded, allows exoneration from trading licence payments for 10 years in Zone II.

6. Company Taxes

The normal rate of company tax is 35% of taxable profit. Where no profit is made, 0.75% of pre-tax turnover. Duration of exemption under regime B of the investment code (if awarded) is 8 years. Moreover, when the company admitted to regime B is located in Zone II (as Ségou is), the exemption continues for a further two, i.e. ten years. The criteria assessed when a company applies for admission to regime B are:

1. Minimum added value rate: 35% of turnover;
2. The advantages that the investment is likely to bring to the state, Malian entrepreneurs and consumers;
3. The external finance thus attracted;
4. The establishment of the company headquarters in Mali;
5. The degree of the company's integration with the national economy;
6. The effect of the investment on the trade balance;
7. The effect on the environment.

Points 2,4,5 and 6 are largely positive, even though the rate of value added only attains around 15% of turnover. We have therefore adopted the hypothesis of the company being exempted from company tax during its first ten years.

H. Analysis of Profitability

1. Reminder of the Evaluation of the Markets

The data concerning the estimated potential of the different segments analysed in 1999/2000 can be found in the chapters on the analysis of demand. They are summarized in Table 33.

The indices used range from base 100 in the year 2000 and concern the estimated size of each segment in the year 2010.

Table 33: Evolution of the Different Market Segments By 2005

Feed Type	Market 1999/ 2000	Index 2005/ 2000	Market 2005	50% Market	Object-ive 2005
Layers	13500	125	16875	8437.5	8500
Pullets	2000	125	2500	1250	1250
Chicks	500	125	625	312.5	300
Dairy product-ion	22000	125	27500	13750	14000
Dairy Growth	18000	125	22500	11250	11000
Cattle Mainten-ance	5000	117	5850	2925	2900
Cattle Starter	4000	109	4360	2180	2200
Cattle Finish-ing	7500	109	8175	4087.5	4100
Sheep Starter	2000	108	2160	1080	1100
Sheep Finish-ing	2500	108	2700	1350	1350
TOTAL	**77000**		**93245**	**46623**	**46700**

It is clear that the size of the factory (50,000t in a single shift) is perfectly compatible with the objective of covering 50% of the market in 2005.

2. Objectives and Production Increase

The objectives above were adopted in the present analysis, with stabilisation of production in the following five years, the analysis being conducted relative to 10 years of production. This hypothesis is prudent, since there is reason not to think that production objectives will continue to rise beyond the fifth year, and that the markets will, at the same time, expand; this would, at first, require only a move to two or three production shifts.

The hypothesis is for a uniform production increase across all categories of product. It would take the following form:

Table 34: Production Increase in Percentage of Objectives

Year	Percentage of objectives
1	50
2	65
3	80
4	90
5	100
5-10	100

These forecasts must naturally be refined according to the segment considered.

3. Overall Investment and Funding

The overall investment comes out as follows:

Table 35: Amount of the Initial Investment

Budget Item	Amount in FCFA
Tangible Assets	2,619,948,000
Intangible Assets	45,000,000
Working Capital Requirement	715,600,000
TOTAL	**3,380,548,000**

Note the high WCR, which is primarily due to the need to store maize over long periods. The WCR doubles during the first four years.

Having spoken to professionals from the banking sector, we established the hypothesis of funding of 3,500,000,000 FCFA, allowing a small margin for unexpected events, and a positive initial cash balance, covered to around 2/3, or 2.3 billion FCFA by a medium term loan over 7 years, at a rate of 12% p.a., with a two year grace period. This loan will come onstream when building of the unit starts, that is, 9 months before production is due to start. It will generate 216 million FCFA in interim interest costs.

4. Results of the Analysis

We have put together three scenarios:

● Scenario 1: (basic hypotheses) corresponds to the sales prices determined above on the basis of the information in Annexes B, C and D. It rests on the principle that there be no increase in the expenses of livestock farmers in the feeding of their cattle, whatever the segment considered.

● Scenario 2: is based on an increase of around 10% in sale prices to the livestock farmer. (In each case, the values are rounded off and the distribution margins adjusted accordingly.) This depends on a well-managed communication campaign, to convince the livestock farmer of the ancillary benefits derived from the use of rationally

designed feeds (time gained, losses reduced, security), which then justify the price supplement.

● Scenario 3 is based on a larger average price increase, slightly less than 20% (given the need to round off the livestock farmer price).

The new transfer price to the livestock farmer comes out as follows:

Table 36: Sales price (F/kg) in Scenarios 1 (basic hypotheses), 2 and 3 (alternatives)

Feed	Initial Price[37]	Variation 1[38]	Variation 2[39]
Layer	140	155	165
Pullet	140	155	165
Chick	140	155	165
Dairy Production	110	120	130
Dairy Gestation	105	115	125
CattleMaintenance	70	80	85
Cattle Starter	75	85	90
Cattle Finishing	75	85	90
Sheep Starter	95	105	115
Sheep Finishing	110	120	130

For the analysis of Scenario 1 (basic hypotheses), please refer to Tables 37.1-37.3. These tables show that:

● With the price hypotheses set out above, Table 37.1, shows the still positive, but highly differentiated, margins over the costs of inputs. Note the high profitability of `sheep' feeds (45-54% margins over input costs), the acceptable margin for `livestock fattening' feeds; but also the margins for `poultry' and, in particular, `dairy' feeds, which are self-evidently too low.

● Table 37.2 gives the forecast operating profit, based on the hypotheses concerning the specified rates of capacity use. Note that value added is low, and the net result remains steadily negative. After a slow improvement during the early years, it again falls after the fifth year, as a consequence of the steady increase in financial costs.

● Table 37.3 concerns liquidity and the funding plan. It shows that the Self-Financing Capacity (SFC) remains negative. It is therefor impossible to provide for the needed increase in the WCR and above all for the reimbursing of debts. The annual cash balance therefore remains negative. The enterprise is burdened with a downward spiralling overdraft. The IRR is negative. It is therefore indispensable to study the effects of increasing sales prices.

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37 THE INITIAL PRICE REPRESENTS THE BASIC HYPOTHESIS, SCENARIO 1.

38 VARIATION 1 REPRESENTS SCENARIO 2:EX-WORKS PRICE INCREASED BY 10%.

39 VARIATION 2 REPRESENTS SCENARIO 2: EX-WORKS PRICE INCREASED BY 20%.

The principle of the second scenario is an increase of around 10% in sales prices. The new prices have been rounded off and the distribution margins adjusted. This scenario is, of course, somewhat simplistic, and one should in fact set about much more subtle readjustments according the circumstances of each market niche. The tables corresponding to this scenario, 38.1-38.3, show that:

● The margins over direct costs are much improved: they are 17-26% for poultry feed, 12-20% for dairy feed and over 50% for sheep feed.

● The net result becomes positive in the third year and the SFC after two years.

● The annual cash balance nevertheless becomes positive only in the sixth year and the consolidated balance only in the ninth year.

● The IRR is, in this scenario, 10.2%, which remains low. The IRR represents the maximum value of the possible discounting rate.

At present, the rate of a low risk investment in Mali is around 5%, to which there should be added a factor linked to the `project risk', which one can also evaluate at 5% minimum, given the still very badly structured environment. The minimum discounting rate that can be chosen in this case is therefore 10%, which gives us an NPV of almost nothing (37M FCFA only).

One variant of Scenario 2 is to simulate a change in raw material prices caused by liberalisation of the grain and cotton oilcake markets. Thus the grain purchase price goes up from F11/kg to 30F, and the oilcake from F35-44/kg. The financial results show that the incidence of this event would be fairly small, since the net profit falls, but the SFC remains positive in the second year. However, the IRR falls to 7.2 and the NPV turns negative (-628 FCFA), which is acceptable and confirms the fragility of the project.

The results of the analysis of Scenario 3 are shown in Tables 39.1-39.3. They show a consolidated situation:

● The SFC is positive in the third year, the annual cash balance becomes positive in the fifth year, the IRR changes to 15.9 and the NPV to 1390M FCFA.

● The liberalised prices variant shows the IRR falling to 13.2 and the NPV to 729M FCFA, which does not effectively endanger the project.

It therefore seems that a price increase of around 20% constitutes the main equilibrium condition of the project.

I. Conclusion

This study has shown that investment in an animal feed factory is profitable, even making allowance for pessimistic scenarios, on condition the price of the products proposed are increased by 20% relative to the current feed costs, which relate to feedstuffs much inferior in quality.

The solvent demand for a complete feed exists in Mali and the factory has been designed to satisfy only 60% of this demand, leaving open the possibility of increasing production capacity if need be.

The analysis has shown that most of the ingredients are available in sufficient quantity on the spot and that the liberalisation of the cotton oilcake market, though it would diminish, would not compromise, the profitability of the investment.

The establishment of this factory must be accompanied by a major campaign to educate the clientele in the advantages of a complete animal feed and by a publicity campaign and public relations to match.

If the conditions set out in this study are fulfilled, the animal feed factory has every chance of success and will serve as a powerhouse for the long-term development of the livestock farming sector in Mali and the sub-region.

Annex I

Calculating the Profitability of Poultry Operations

The PDAP attempted a typology of the poultry farmers of Bamako. Three types were found:

● **Type 1:** often beginners, with a maximum of 500 birds. Production of 5-10 egg-trays/day. Buy chicks through intermediaries (around F800). Approximate veterinary monitoring. Equipment and buildings frequently inadequate. Feed supplies from local mills, sometimes on credit during start-up. No distinctive pullet formula. No CMV. Frequent stockout problems.

● **Type 2:** 500-2000 birds. Production up to 30 egg-trays/day. Buy chicks directly or in association with one another (around F700). Relatively rigorous veterinary monitoring. Supplied by district markets. Stocks sometimes low. Feed manufactured daily. One or two salaried staff.

● **Type 3:** 2,000-10,000 birds. Production up to 130 egg-trays/day. Sometimes also produce broilers. Direct supply of chicks (around F650). Employ vets to monitor the procedure. Well-designed buildings, self-contained equipment for feeding (grinder, scales). Large ingredient stocks but constantly facing feed quality problems.

We may therefore take the figure of 1000 layers as offering a sort of threshold of professionalization at which the activity of the egg-producer begins to stabilise. The production of broilers involves higher technical and risk levels (mortality, low demand) and would seem to be confined to experienced poultry breeders. They are currently rather few.

Profitability of a Small/Medium Poultry Farm:
1000 layers

Hypotheses:

● 320 eggs/cycle, or 200 eggs per bird present per year; price F1300/egg-tray (30 eggs);
● Cull at 19 months of life (82 weeks), whence 63% of birds present culled/year at a price of F1100;
● Chick mortality: 2% of flock present per month, or 68% of the initial flock still alive at the cull. This is a cautious estimate, the best farms having a rate of at least 1.5%, equivalent to 75% of the initial flock at the cull.
● Chick price F700
● Consumption 35.8kg/year, at average cost of F135 (including grinding)
● Pharmaceutical expenses F15,000/mth
● Veterinary expenses around F50,000/cycle = F30,000/yr.
● One employee at F20,000/mth total cost
● Density 5/m^2. Building 200m^2, plus paths. Cost 3M FCFA
● Depreciation over 10 years.

Table 5a: Accounting Model of Annual Profit (Small/Medium Farm) (per Flock of 1,000)

Annual Production	- Sale of Eggs: 6700 egg-trays at 1300 - Cull of chickens: 430/yr x 110 - Total Production:	8,710,00 473,000 9,183,000
Annual Expenses	- 1200 chicks at 700: - Feed: 35,800 kgs x 135: - Pharmaceutical costs: ● **Total proport-ional costs:** - Veterinary expenses: - Workforce: - Depreciation of buildings: ● **Total fixed expenses:**	840,000 5,062,500 180,000 **6,082,500** 30,000 240,000 300,000 **570,000**
	● **Net Profit**	**2,530,500**

Profitability of a large poultry farm (4,000 layers, 4 flocks of 1,0000)
Hypotheses:

- Order capacity of 1000 chicks at 680/chick
- Own feed-manufacturing at F130/kg
- Scale economy on buildings (depreciation 250,000/200m^2)
- Equipment depreciation: 100,000/yr = 250,000/flock
- Hammer mill 1 t/hr, 3.5 hp (= 2Kw), cost F500,000, 10 year depreciation
- Cost of KwH = F92
- Workforce of 3 employees = 0.75/flock

Table 5b: Accounting Model of Profits (large poultry farm) (by flock of 1,000)

Annual Production		**9,183,000**
Annual Expenses	- Chicks: - Feed: - Energy: - Workforce: - Depreciation: - Pharmacy and vet (Unchanged): **Total Expenses:**	816,000 4,654,000 7,000 180,000 250,000 210,000 **6,117,000**
	Net Profit	**3,066,000**

Net remuneration per layer is therefore of the order of 2,500-3,000 FCFA, and the rate of net margin 28-30%, which is excellent.

Annex II

Composition of Proposed Rations

Annex III

References

Annex IV

Technical Offer

Annex V

Term Of Reference for the Study